THURSDAY, JUNE 18, 1885

BÜTSCHLI'S "PROTOZOA"

Bronn's Classen und Ordnungen des Thierreichs. New Issue. (Leipzig: C. F. Winter, 1883-4-5.)

THE important work on the lowest division of the animal kingdom which Prof. Bütschli, of Heidelberg, has undertaken for the publishers of the well-known series of zoological treatises originated by the late Prof. Bronn, is so far advanced as to enable us to form some estimate of its merits and to call for an extended notice. The separate parts of Prof. Bütschli's work which have appeared at intervals during the last two years have now accumulated so as to form a large octavo of 900 pages and 50 plates. The whole of the Protozoa have been discussed with the exception of the Ciliata, the Dino-flagellata (formerly called Cilio-flagellata), and the Acinetaria. The work does not comprise in its scope the Mycetozoa, which should, in the opinion of the present writer, be included in the animal kingdom. This is the less to be regretted, since an excellent work on this group has been recently published by Dr. Zopf, of Berlin, in the "Encyklopädie der Naturwissenschaften," and may be obtained separately of the publishers, Trewendt, of Breslau.

That the Mycetozoa are to be considered as animals rather than as plants is the opinion of no less an authority than the botanist De Bary, who has done more than any other observer to elucidate their life-history and structure.

Bütschli divides the Protozoa into classes as follows—the Sarkodina, the Sporozoa, the Mastigophora, and presumably the Ciliata and the Tentaculifera, though of the last two he has not yet written.

The Sarkodina are divided into the sub-classes Rhizopoda, Heliozoa, and Radiolaria.

The class Sporozoa contains the sub-classes Gregarinida, Coccidia, Myxosporidia, and Sarcosporidia.

The Mastigophora are grouped in sub-classes as Flagellata, Choanoflagellata, Cystoflagellata, and Cilioflagellata (now altered to Dinoflagellata).

Each of the sub-classes is treated of in turn in the thoroughly systematic and comprehensive manner which the readers of Bronn's "Thierreich" know so well and have so long appreciated. The treatment commences with a "Historical Review of the Development of our Knowledge of the Sub-class," which is no formal repetition of familiar commonplaces, but a really critical statement of the share contributed by various earlier naturalists to the building up of our present conceptions on the subject. This is followed by a wonderfully complete list of memoirs and papers relating to the group—under the heading "Literature." We have in many instances tested the completeness of these lists, and have found that even short papers in obscure periodicals which happen to contain facts of real importance have been duly hunted up and recorded by Prof. Bütschli.

Then follows a "Short Survey of the Morphological Characteristics of the Sub-class and its Chief Divisions," and after this each prominent morphological factor is taken separately and its variations in the group very thoroughly discussed, references being given to the widely scattered writings of the numerous microscopists who have advanced this or that view or added this or that quantum of fact to our knowledge. Thus in the portion of the work relating to the Rhizopoda we find—

(1) The shell-structure of the Rhizopoda. A. Material of the shell—(*a*) chitinous shells; (*b*) calcareous shells; (*c*) shells built up of foreign particles; (*d*) siliceous shells. B. The morphological structure of the Rhizopod shell—(*a*) homaxonic shells; (*b*) monaxonic shells; (*c*) polythalamous shells; (*d*) abnormal shell-formation.

(2) The structure of the soft body of the Rhizopoda—(*a*) general characters of the soft body; (*b*) properties of the protoplasm of the Rhizopod-body in general; (*c*) differentiation of the protoplasm into special zones or regions; (*d*) coloration of the protoplasm; (*e*) peculiar bodies enclosed by the protoplasm, namely, non-contractile vacuoles, gas-bubbles, and peculiar products of metabolism, contractile vacuoles, nuclei; (*f*) pseudopodia, movement and inception of nutriment in the Rhizopoda; (*g*) gelatinous investment of the soft body.

(3) Relation of the soft body to the shell and formation of the shell by the soft body.

(4) Reproductive phenomena, colony-formation, and encystment of the Rhizopoda—(*a*) reproduction by simple division or budding; (*b*) colony-formation in connection with the division or budding of the Rhizopoda; (*c*) encystment in connection with or without reproduction; (*d*) copulation and conjugation in the Rhizopoda; (*e*) review of the attempts made to prove the existence of a sexual reproduction in the Rhizopoda.

(5) Biological relations of the Rhizopoda—(*a*) habitat; (*b*) nutrition; (*c*) dependance on external life-conditions.

(6) Taxonomy of the Rhizopoda—(*a*) historical development; (*b*) review of the system of the Rhizopoda, with brief characterisation of the divisions, inclusive of genera.

(8) Geographical distribution of the Rhizopoda.

(9) Palæontological development of the Rhizopoda.

This exhaustive discussion of the Rhizopoda occupies about 250 pages and 13 plates, in which the most important forms are figured: the figures being selected from all sources, and showing not only shell-structure but all that is known with regard to the protoplasmic body.

In the same thorough manner the subsequent groups of Sarkodina, of Sporozoa and Mastigophora are dealt with.

One point, however, to which we have not yet alluded gives Prof. Bütschli's work an altogether exceptional value. From what we have hitherto said it might appear that the work is simply a well-digested and critical survey of other men's work. This is not the case; the discussion of each group possesses a special value and importance from the fact that Prof. Bütschli has made very extensive researches himself in regard to the Protozoa, and has especially given attention to doubtful points, so that he is able to speak with the authority of a specialist in nearly every case. Portions of these researches, for instance those on the Radiolaria, on the Gregarinida and Myxosporidia (Psorosperms), and on the Flagellata have been already published from time to time during the past five years by Prof. Bütschli in various scientific journals. They have everywhere excited the greatest interest and have been recognised as most important additions to knowledge. In the present work they appear in due

place aad enable Prof. Bütschli to give a decisive opinion upon many points on which authorities have hitherto differed. Many of the illustrations in the admirably engraved plates are also original.

We may perhaps remind our readers that it is to Prof. Bütschli that we owe the first important paper in the recent development of our knowledge of the karyokinetic figures of dividing cell-nuclei. It is his investigation which demonstrated the identity of the changes in the nuclei of Ciliate Infusoria with the curious fibrillation of normal tissue-cells when in course of division, and more than any others have given a wide basis to the recent generalisations on this subject.

Our author is not only extremely fair and scrupulous in citing all discoverable authorities for the facts which he sets forth as to the structure, &c., of Protozoa (our English microscopists of all ranks will find themselves cited and fairly considered), but he exhibits admirable judgment, temper, and caution in his treatment of vexed questions. He has wisely withheld his full discussion of the classification of the Radiolaria until such time as Haeckel's *Challenger* work on the group is published. In the meantime his analysis of the various forms of skeleton which occur in that group is a masterly essay on a very difficult subject.

With regard to the question of the chlorophyll corpuscles of some Protozoa—considered by Brandt as parasitic Algæ—we gather that Prof. Bütschli leans to the acceptance of that view; but we shall look for a more definite judgment from him in relation to that question when he has to discuss such forms as the Ciliata, *Stentor*, *Bursaria*, and *Ophrydium*.

It is noteworthy that Prof. Bütschli includes the Volvocina and the "Protococcus" forms in the Flagellata, being convinced of their relationship here in spite of their "holophytic" nutrition.

It would be impossible here to point out the numerous new views of importance which are advanced in Prof. Bütschli's work. It must be sufficient to say that the book is absolutely invaluable to every student of microscopic life, and is perhaps the most remarkable attempt yet made by a distinguished original observer to co-ordinate and render available for use the entire series of works of his predecessors in a large and important field of study.

E. R. LANKESTER

PHÆNOLOGY

Resultate der wichtigsten pflanzen-phänologischen Beobachtungen in Europa, nebst einer Frühlingskarte. Von Dr. H. Hoffmann, Professor der Botanik in Giessen. Anhang, Dr. Egon Ihne, *Die Norwegischen, Schwedischen, und Finnländischen Beobachtungen.* (Giessen: J. Ricker'sche Buchhandlung, 1885.)

THIS work, the results of forty years' labour, forms a most important contribution to the literature on the subject of phænology.

The work begins with an introduction, in which is explained the importance of phænological observations, particularly with regard to comparative climatology and biology. Then follows an investigation of the degree of accuracy to be obtained by this kind of observation, succeeded by a discussion as to how many years such observations ought to be continued for obtaining useful and trustworthy information for comparative investigation. A table is then given of those plants and their phases which the author, after forty years' observations, thinks the most proper for adoption with a view to international reception. The number is fifty-three, and they are arranged according to the calendar, to facilitate observation; which system appears with regard to accuracy preferable to an alphabetical arrangement.

A short notice follows of the most important general results of the work with respect to climatology and biology, abstracted from the observations from the whole of Europe. At the end of the introduction the author points out the next tasks for phænological researchers.

The remainder of the book contains an alphabetical list of all phænological stations throughout Europe (about 2000), with the geographical situation and elevation above sea-level. Under each station are given in an alphabetical arrangement the mean dates of the simple phases known from the place, with the number of years of observation.

It is to be seen that from a great number of these but one or two years' observations have been published, whereas others extend to above thirty years. These dates are to be employed for comparing any single place with all the others. The mean dates are given as completely as possible, because such comparisons are the chief object of the author for publishing this work. They are extracted and calculated from a vast number of lists published in a great many periodicals and works of all nations.

With regard to spring flowers, the author himself has followed the plan of comparisons, giving under each station an indication of the number of days the single species open their flowers, sooner or later than at Giessen, the residence of the author, from which place, generally speaking, the most comprehensive observations have been published. In a "spring map" of Europe at the end of the book the results of these investigations are entered, by which the mean progress of spring through different countries may be seen at a glance.

OUR BOOK SHELF

Louis Pasteur, his Life and Labours. By his Son-in-Law. Translated from the French by Lady Claud Hamilton. (London: Longmans, Green, & Co., 1885.)

THE name of M. Pasteur, owing to his many brilliant and eminently practical discoveries, has been for some years so prominently before the general public that a popular and connected account of his life and labours cannot fail to be interesting and instructive reading to every educated member of the community. In this respect the present volume must be considered a signal success and a valuable addition to popular scientific literature. But the importance of the book reaches a step further, for it gives to the scientific world an authentic account of the development and progress of M. Pasteur's discoveries, since it is written by one who has been and is still living with M. Pasteur in the bonds of intimate friendship, and who has received his information directly from M. Pasteur himself. While to the general reader the achievement of a discovery is the only and great point of interest, to the scientific reader it is only one of many, the history of a discovery being one of them, and not the least important one, for it reveals methods and manner, and it gives us a true insight into the working of the

mind, more so than the contemplation of the actual results. Looking at the book in this sense, we must consider it of inestimable value to every worker in the same field of research.

The many and great researches of M. Pasteur—amongst which may be mentioned his discoveries that every one of the many kinds of fermentations depends on the growth and activity of a definite and specific microbe; his long-continued controversy and final refutation of the doctrine of spontaneous generation, his immensely practical discoveries on the silkworm diseases, on the attenuation of the virus of splenic fever and of hydrophobia are described with great lucidity and their history and progress rendered in a very spirited and fascinating manner. Reading the volume, one does not know what to admire more in M. Pasteur's life and labours — the way in which a problem is stated, worked, and solved in all its theoretical and practical bearings; the energy and perseverance with which he forces nature to yield up her secrets; the fertility and resources of his genius, or the ready way in which he goes to work to set at rest by direct experiment all objections and to remove possible sources of error. His is a truly grand life and his labours grander still!

The translator is to be congratulated on the admirable way in which she has fulfilled her task. Prof. Tyndall's preface forms an interesting and valuable part of the book. E. KLEIN

The Microtomist's Vade-Mecum. A Handbook of the Methods of Microscopic Anatomy. By Arther Bolles Lee. (London: J. and A. Churchill, 1885.)

IN the preface the author tells us that the aim of the book is to put into the hands of the instructed anatomist "a concise but complete account of all the methods that have been recommended as useful for the purpose of microscopic anatomy," and also "that it is to serve as a guide to the beginner." After a perusal of the book we venture to say that, although the book will prove useful, it is neither a concise, still less a complete, account of all the methods, nor will it serve as a guide to the beginner. As far as we can see, it is a collection of formulæ, published by various authors in various journals and archives, and particularly reported in the *Journal* of the Royal Microscopical Society. The formulæ are more or less promiscuously given, and without an attempt of intelligible selection. For many formulæ references to their authors are given, but in some places these references are incomplete, in others they are wrong, since methods discovered by one are ascribed to another. Nor can we see the use of describing a host of minute and sometimes quite insignificant modifications of a certain method, as A's, B's, C's, &c., method.

As regards the beginner, we venture to say that the book will fail to come up to the expectations of its author. What the author for this purpose ought to have done is to give us a list of ready methods which he himself has tried and found useful in the examination of the various tissues.

The important branch of the examination of living issues, the methods used for the application of reagents, heat, gases, electrical currents, &c., on fresh and living tissues are not included in the book; their treatment, and a few illustrations of apparatus used in microscopic *technique*, would prove a useful addition. E. KLEIN

LETTERS TO THE EDITOR

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.

The Late Prof. Clifford's Kinetic

PROF. TAIT, in his notice of Clifford's "Common Sense of the Exact Sciences" (NATURE, vol. xxxii. p. 124) has brought so prominently forward the statement made in Prof. Pearson's footnote—"the manuscript of the 'Kinetic' was left in a completed state," that I think it is fitting I should somewhat anticipate what will ultimately be stated when the manuscript in my hands has been printed. All the manuscript bearing upon the "Dynamic," after having, I think, passed under Mr. F. Pollock's eyes, was handed over to me, and with it Mrs. Clifford gave me, for use,[1] nine German text-books in case I should need them to fill up any gaps in the manuscript. It is needless to say that there have been "reasons" why this manuscript has not hitherto seen the light; suffice it now to say that the *continuous* portion has been received by Messrs. Macmillan, and the printing is to proceed forthwith. But of what does the *continuous* part consist? I have a draught before me of the work as originally contemplated by the author: Books i., ii., iii., form the "Kinematic"; Book iv., entitled "Forces," is broken up into ten or eleven sections. It is this portion which is *continuous*, and which takes up about forty pages of manuscript. Book v. was to treat of "Stresses;" Book vi., of "Heat;" and Book vii., of "Waves and Vibrations." Of these latter books I have only stray leaves here and there. It is said "Fools rush in where angels fear to tread." I certainly do not propose to try to supplement Clifford's work, but what I do propose is to get out all the *continuous* part in continuation as approximately as I can of the "Kinematic" and to relegate the odds and ends to an appendix. If any mathematician thinks some other course preferable, I shall be glad to let him see the "slips," and will hope to profit by his advice. I am in the receipt of letters from distinguished teachers which express a hope that the lectures I referred to (NATURE, vol. xxvii. p. 4) may see the light; but this point is still, I believe, under consideration. R. TUCKER

University College School, June 13

Sky-Glows

A MAGNIFICENT display of red sky-glow has been seen here. The last observed was in September last (the 17th, the 27th, and the 28th), and only feeble ones have been noticed since up to June 11. At that date the sky glowed with a magnificent grayish pink on the whole of the northern horizon until 9 o'clock p.m. Yesterday the glow was still brighter, and at 9 15 p.m. it extended over the whole of the northern and north-eastern horizon. It was brighter than even last year, but acquired its maximum of brilliancy at a later hour than last summer.

Clairvaux-sur-Aube, France P. K.

Flying Fish

AN excellent opportunity of observing the aerial means of propulsion in the flying fish was afforded me during a six days' calm lately when crossing the Bay of Bengal. This must be my excuse for again touching this subject. I watched day by day some hundreds rise under the bows of the ship. The water surface was a glassy calm. As each fish rose it spread its wings at once, apparently beating the surface with them two or three strokes before they steadied out. I say apparently, for it was not a definite beat so much as a struggle to rise. The tail which, of course, under water was in rapid motion, to escape from the ship, now gave ten or a dozen rapid beats, which could be counted by the ripples on the still surface, and the fish was off in aerial flight. As each fish lost the impetus of the first rise, which generally happened at about forty yards, the binoculars showed us the anal fins, which had till now been fully extended, drooping to feel the water. As soon as the surface was felt the tail was quickly introduced, and five or six smart strokes, also indicated by ripples, brought the impetus up again and carried the fish about another thirty yards, when another droop sent it on again, and so forth, some of the older fish travelling in this way 400 to 500 yards. The younger fish frequently fell awkwardly in this attempt to regain impetus. Where waves are running it requires a clever fish to gain impetus by a few judicious strokes on the crest of a wave, and many a fish tumbles over in the attempt.

I once saw a fish rise close to the ship's quarter, and it flew parallel with the ship, pursued below by a dolphin or bonita. The latter followed every sway of the flying fish, keeping almost under it. At the first dip of the tail the pursuer made a dart forward, but missed it, and again dogged its pray by keeping

[1] These books are to be presented to University College Library after I have done with them.

just under it. On the second dip the tail went into its pursuer's mouth, and there was an end of the flyer. It always struck me that it seemed a strain on the fish to keep the wings extended.

May 15 ALFRED CARPENTER

THE UNIVERSAL MERIDIAN[1]

AFTER some preliminary historical matter Dr. Janssen proceeded:—The question as to which of all the meridians encircling the earth ought to serve as the starting line in the general numeration of the longitudes, is the question known as that of the *prime meridian*—a famous question oftentimes taken in hand, never definitively settled, and which the Congress of Washington was charged to decide. Such was at least its intention.

The ancients, who had just ideas in all matters, perfectly understood that a prime meridian ought to be placed at the origin of the lands to be measured. Marinus of Tyre, and after him Ptolemy, chose quite naturally, as the point of departure for their longitudes, the extremity of the world which was best known to them. What was this extremity? It was the islands which navigators encountered beyond the pillars of Hercules in an enchanting climate, where the inhabitants, freed from every toil, lived in peace and happiness on the abundant spontaneous fruits of a prodigal soil, the Fortunate Isles, as they were called, which people pleased themselves with assigning, as a final resting place (Elysian fields) to the souls of heroes!

Homer, Hesiod, Pindar, Plutarch, speak to us of these Fortunate Isles, which were then regarded as the extreme limit of the western dependencies of Africa. Afterwards they were the unknown solitudes of the ocean.

It is from these isles, then, that the great heir of the geography of the Greeks starts his numeration of longitudes. Here again, however, the ignorance of the ancients in the matter of measures did not allow the maintaining of so natural a point of departure. The indifferent knowledge of the position of the Fortunate Isles damaged the whole system, and people later on were compelled to revert to the continent where the measures were less uncertain.

Following Greek science came the middle ages, when the scientific idea disappeared, and was replaced by a religious or political idea. The first line of longitudes was taken anywhere. People took their meridians from capitals, or remarkable places; every one chose his own centre, and the confusion grew to be intolerable. It is noteworthy how it was France which gave the signal for the resuscitation of the scientific idea in this question, and that it is to the great Richelieu we owe it.

It is, however, a false idea of Richelieu's action to consider it as directed by a pure intention of scientific reform, and by the desire alone of serving the general interests. Richelieu is above all a political spirit, and political interests dominate his preoccupations. At the same time, however, he is a unifying and innovating genius, who feels the necessity of order and serves that necessity by general, great, and elevated measures, for such is the form of his spirit.

What, in fact, was the point of departure of a reform such as science disengaged from all personal interest would alone dictate at the present day? A jealous quarrel among maritime nations in reference to commerce!

At the commencement of the seventeenth century France made a trial of commerce in distant parts, particularly in the Indies and America.

The navigation and traffic of these countries were then in the hands of the Spanish and Portuguese, who, however little they agreed on the division of these rich spoils among each other, were nevertheless wonderfully united when there was a question of interdicting others from sharing in them. The French ships appearing in the seas either of the East or West Indies were, in point of fact, chased by the Spaniards and the Portuguese! Awaiting the time till he had rendered the French navy strong enough to dispute with these nations a property which on the whole was the right of all the world, Richelieu sought to draw around France a maritime zone of protection. He accordingly negotiated and obtained that on this side of the prime meridian fixed on this occasion and to the north of the tropic of Cancer every French ship, whencesoever it may have come and whatever its cargo, should be safe from the pursuit of foreign vessels. Beyond these limits the argument of the strongest was to have force. France was at peace with Spain and Portugal on this side, at war on the other. A curious state of affairs, recalling to some extent the word of Pascal: "Vérité en deçà, erreur au delà!"

And yet have we really the right at this day to look on an arrangement of this kind as such a strange one? Have we not now what the casuists of international law call the *état de représailles*—a state in virtue of which one may blockade the ports of a nation, burn its arsenals and destroy its armies, without being in declared war, and without ceasing diplomatic relations with it?

The object of the great Minister was evidently to secure a refuge for our marine till such time as it was able to contend with others—a goal for which he laboured with such admirable success that before his death our navy was constituted and the basis laid of that colonial greatness which came with Louis XIV. and Colbert.

Such, then, was the political motive at work. But in pursuing this question of colonial commerce the mind of Richelieu was for a moment turned to geography. He needed a pure line of demarcation, not liable to be disputed, and found it in the ancient meridian of the Canaries. He resumes the geographical idea of Marinus of Tyre and of Ptolemy. He places his meridian as far to the west as possible in the archipelago of the Canaries—in the island of Ferro, and the longitudes are to be counted east of it. All the other meridians of the continent are excluded.

Accordingly, and I insist on the fact, all the qualifications of a universal meridian, such as science might be able to establish at this day, were combined in Richelieu's meridian.

(1). It is universal and fit to be so, seeing it personifies no nation, but is, on the contrary, the determination of a purely geographical idea; namely, the position farthest to the west of the ancient world.

(2). The numeration of the longitudes is very natural. It brings the numerical augmentation of the longitude into harmony with that of the local time. It sets forth no negative longitude—a system which, in our opinion, is defective, when there is a question of universal numeration of longitudes.

(3). It places the first meridian in the sea, as geographers have always desired.

The appointment of Richelieu had but one fault: it was in advance of its time—not in respect of its utility and urgency, but of its means of realisation.

In order to establish a meridian at any point it is necessary to be able to connect this point exactly with all well-known points which are to be brought into relation to it. Now, by reason of various circumstances, chief amongst which was the state of war then prevailing, the longitude of this island of Ferro was not known till a century later, when P. Fouillée, astronomer and naturalist, proceeded to the Canaries by order of the King and the Academy, and there made observations on the occultations of the satellites of Jupiter, whence he determined the position of Orotara in Teneriffe, and consequently, by means of a triangulation, the position also of the island of Ferro.

[1] Lecture by Dr. Janssen at the Paris Geographical Society.

In the meantime a conventional position had been arranged for the island of Ferro. In fact, at the beginning of the seventeenth century our geographer Delisle is found placing the meridian of the island of Ferro on his maps 20° W. from Paris.

The grand geographical idea of Richelieu was, accordingly, not maintained in its integrity. Paris, in fact, gave the point of departure.

Delisle was a geographer of very great merit, and accomplished a real reform in the science by always seeking to establish astronomical determinations as the basis of geography. Delisle and d'Anville placed France in the seventeenth century in the front rank in geography. Be it added that, while France had thus an undisputed superiority in geography, she at the same time took the initiative in inventing hydrographic methods, and producing the most beautiful hydrographic works, as I had occasion to call to remembrance at the Congress.

In thus speaking of the labours of France shall we not be allowed to recall our present activity in the branches which engage us? I shall say but a word in passing. But in fine, are we not accomplishing great things even at the present day? The creation of the port of Rochelle, established on new and profound scientific principles; the geodetic junction of Spain and Africa; the great geodetic labours of France resumed; the publication of the astronomical and nautical ephemerides, the most complete and perfect in existence; the fair series of determinations of longitude of high precision, undertaken under the auspices of the Bureau of Longitudes; those sublime cosmogonical theories which are being elaborated at this very moment; finally, and without passing beyond the domain of geography, let us not forget the great enterprises of our president, who everywhere vindicates the genius of France, and whom age seems to spare in the interest of our glory—have we not in all that a sum of sterling substance, and is it not proper to call it to mind at a moment when every one is putting his claims forward?

These preliminary explanations made, we may now, with your permission, address ourselves to an analysis of the labours of the Washington Congress.

This Congress, assembled by the zeal of the United States Government, was formed by the diplomatic and scientific representatives of the different States invited. It was officially charged with the task of studying the question of a universal meridian and of cosmopolitan time, and of formulating propositions, which, it is true, were not to be binding on the Governments represented, but were yet to serve as a basis for further negotiations and definitive resolutions.

When the invitation of the American Government reached the Government of France, the latter applied to the Academy to name the delegates which should represent France scientifically at the Congress. This step was followed by the appointment of a Grand Commission comprising representatives of all the sciences and services interested, and in which the Academy of Sciences was largely represented.

This Commission, presided over by the Dean of our Astronomical Section, held numerous meetings, at which they discussed with the greatest care and with high authority the questions composing the programme of the Washington Congress. The resolutions which this Commission adopted, formulated in a remarkable report of M. Gaspari and fully accepted by the Government, formed the basis of the instructions given to the French delegates.

The Congress opened on October 1 in the Diplomatic Hall of the Department of State.

On the formal demand of the French delegation the Congress allowed that the motions and speeches delivered in the English language should be translated into French, and that the *procès-verbaux* should be drawn up in the two languages. To secure the accuracy of the French version M. Janssen accepted the duties of secretary.

The Congress invited certain learned men present at Washington to assist at the sittings, and to take part in the discussions. Among them may be named Messrs. Newcomb, Asaph Hall, Sir William Thomson, and Prof. Hilgard.

On examining the composition of the assembly it will be seen how largely England and America were represented, and yet, to add to the force which such a numerous and eminent representation was calculated to give them in the discussion, there was joined to it, under the form of invitation, the support of the most eminent men of learning of America or England present at Washington.

Finally, without at all wishing to call in question the independence of any one present at the Congress, it is yet difficult not to be struck by the fact of invitations being addressed to all the small States politically allied with the United States.

Such was the arena on which France was called to defend her interests.

Luckily, however, we had no personal interest to contend for. The France of the nineteenth century does not, any more than the France of the eighteenth and seventeenth centuries, deem herself entitled to consider national interest in questions of a scientific and universal character.

In conformity, therefore, with the spirit which ruled the institution of the metrical system the French representation at the Washington Congress solely maintained the principle of a meridian such as science would designate and such as would be most advantageous for the general interest.

At the opening of the sittings a member of the American delegation, expressing, no doubt, the sentiment of his colleagues, at once proposed the meridian of Greenwich as the international meridian. If this proposition had been adopted the main question which called the Congress together would have been decided, and that, so to say, without discussion, and without the questions of principle and general interest, which we wished to defend, being so much as entered on.

The delegate of France raised his voice against this summary and inadmissible method of procedure. He pointed out that, before proceeding to choose any meridian in particular, it was necessary to come to a decision on the question as to whether a universal meridian should be fixed upon or not, and, if this question were settled in the affirmative, according to what principles they should choose this meridian.

The legitimacy of this demand was evident. It was accepted, and the proposition of the American delegate was temporarily withdrawn.

The question of fixing a single meridian of departure for all nations having been submitted to the Congress, it was unanimously agreed to choose such a meridian.

It next remained to be decided according to what principle this meridian should be chosen—whether, namely, the choice should be made among the observatories already existing, or whether the choice should be made with a view exclusively to geographical conditions, and to the service which the meridian was destined to render.

On this question the French scientific delegate begged permission to speak, and delivered the following discourse:—

"If after so many fruitless attempts recorded by history to arrange a single universal system of longitudes this question is now again resumed, then in our opinion it has no chance of definitive success unless it is established on a purely geographical basis to the rigorous exclusion of all national rivalries.

"We do not, therefore, come here to support a candidature, we put ourselves completely outside the arena of

debate, and are consequently infinitely freer to express our opinion and discuss the question from the one point of view of the interests of the projected reform.

"The history of geography shows us very numerous attempts at the unification of longitudes, and on searching into the causes of the failure of those attempts, many of them very happily conceived, one is struck by the fact that they seem reducible to two main causes, one of a scientific, the other of a moral nature. The cause of a scientific nature lies in the inability of the ancients to determine exactly the relative positions of points taken on the globe, particularly in the case of an island removed from a continent, where the distance between the two was not determinable by itinerary measures.

"It was thus, for example, that the first meridian of Marinus of Tyre and of Ptolemy, placed in the so-called Fortunate Islands, could not continue to be used, notwithstanding the advantage belonging to the choice of a position in the extreme west of the then known world, on account of the uncertainty attaching to this point of departure.

"This very regrettable reverse served to give a wrong direction to the question. People were obliged to revert to the continent. Instead of regarding a common origin of longitudes indicated by nature, people took their first meridian from a capital, from remarkable places, from observations. The second cause to which I referred, the cause of a moral kind—namely, national jealousy—led to the multiplication of geographical origins, whereas the nature of things would have demanded their reduction to one single origin.

"In the seventeenth century Cardinal de Richelieu, seeing this confusion, wanted to resume the idea of Marinus, and assembled at Paris learned men of France and foreign countries. The famous meridian of the island of Ferro was the result of their conferences. Here is a lesson which we ought not to lose sight of: the meridian of the island of Ferro, which had at first the purely geographical and neutral character alone able to render it, and maintain it as, a first international meridian, was displaced from its primary position by the geographer Guillaume Delisle, who, to simplify the figures, placed it in round numbers 20° west of Paris. This unhappy simplification completely changed the principle of impersonality. It was no longer an independent meridian, but the meridian of Paris disguised. Nor were the consequences slow in making themselves felt. The meridian of the island of Ferro, from that time regarded as a purely French meridian, wounded national susceptibilities, and thus lost the future which was certainly in store for it had it remained true to its first intention.

"This was a real misfortune for geography. Our maps in their process of improvement ought to have maintained the unity of departure, instead of confusing it ever more and more.

"If from the time when astronomical methods were sufficiently advanced to allow the fixing of relative positions with the degree of precision required for general geography (a state obtaining from the end of the seventeenth century), the idea of Marinus of Tyre, so just and so geographical, had been resumed, the reform would have been effected two centuries sooner, and we should now have been in the full enjoyment of it. But people fell into the error of losing sight of the very principles of the question, an error to which the foundation and multiplication of observatories at that time greatly contributed. Furnishing relative positions, as they of course did, with great precision, each of these establishments was chosen by the nation possessing it to give it a point of departure for longitudes, so that the intervention of astronomy in these questions of a geographical nature—an intervention which, properly understood, should have been so advantageous—served only to remove us further from the object to be attained.

"The study of these questions leads us to establish a very necessary distinction between the meridians of a geographical or hydrographical nature, and the meridians of observatories.

"The meridians of observatories must be regarded as essentially national. Their office is to enable observatories to depend on each other for the unification of their observations. They also serve as a basis for geodetic and topographical labours executed in connection with them. Their functions, however, being of an entirely special character, ought in general to be limited to the country possessing them.

"The first meridians in geography, on the other hand, do not require to be fixed with a precision quite so delicate as that exacted by astronomy; but in return their domain ought to be comprehensive, and while it is serviceable to multiply observatories, it is necessary to reduce to the utmost the origins of longitude in geography.

"It may further be said that if the site of an observatory ought to be chosen under considerations of an astronomical description, a meridian of departure in geography ought to be fixed on grounds of a geographical description.

"Have these two so different functions always been well comprehended, and a distinction of such vital moment properly observed? By no manner of means.

"Seeing the observatories, by reason of the labours of high precision executed by them, furnish admirable data, each nation in a position to do so has assigned to its principal observatory not only the geodetic or topographical works undertaken at home—a task very proper to it; but likewise the general works of geography or hydrography executed abroad—a confusion of functions comprising in it the germs of all the difficulties under which we now labour.

"In proportion, therefore, as cartographic labours accumulated, the necessity of establishing unity in all that relates especially to general geography became more and more felt. This explains how the question of a single meridian of departure has been so often raised in recent times.

"Among the assemblies occupied with this question that principally deserving our attention is the one held at Rome last year. For many even of our colleagues the conclusions adopted by the Congress of Rome settle the matter. Those conclusions must, therefore, very particularly engage our attention.

"On reading the reports of the sittings of that assembly I was struck by the fact that in a meeting embracing so many men eminent for their learning and speculations, it was the *Utilitarian* side of the question which was especially considered, and which finally dictated the sense of the resolution taken.

"Thus, instead of laying down the great principle that the meridian which should be offered to the world as a point of departure for all the longitudes of the earth ought, above everything else, to have an essentially geographical and impersonal character, the question was simply asked, which among the meridians of observatories was the one possessing—permit me the expression—the largest following (*la clientèle la plus nombreuse*).

"In a question of a geographical, much more than of a hydrographical, interest, as almost all mariners confess (seeing that, in fact, there exist but two prime hydrographical meridians, Greenwich and Paris), a primary meridian is taken, the dominating character of which is marine. And this meridian, instead of being chosen according to the configuration of the continents, is claimed for an observatory. That is to say, the prime meridian is chosen for a mere chance spot on the globe, and one which, moreover, is very inconvenient, for the function the meridian is intended to perform. Instead, finally, of profiting by the lessons of the past, an element of national rivalry is

introduced into a question which ought to unite the votes of all interested.

"Well, I say that considerations of economy and of use and wont ought not to blind us to the principles which should govern this question, and which can alone render its settlement universally acceptable and permanent.

"But further, this argument of economy, and use, and wont, which is advanced as a reason of determinative force, has validity, it is true, for the majority for whom it is brought forward, but for them alone, and leaves for us exclusively the burden of change in habits, publications, and maps.

"Seeing the report holds us of so light account in the balance, allow me briefly to recall the past and the present of our hydrography, and for this purpose I cannot do better than cite a few passages from a work communicated to me, and emanating from one of our foremost hydrographers. 'France,' says he, 'created more than two centuries ago the oldest nautical ephemerides in existence. She was the first to conceive and execute the great geodetic operations having for their object the construction of maps civil and military, the measure of meridional arcs in Europe, America, and Africa. All these works were and are regulated by the meridian of Paris. Almost all the astronomical tables which the astronomers and mariners of the entire world make use of at this day are French, and calculated in reference to the meridian of Paris. As regards oceanography, more particularly marine surveying, the precise methods employed at the present day by all the nations are of French origin, and our maps, all based on the meridian of Paris, bear names such as those of Bourgainville, La Pérouse, Fleurieu, Borda, d'Entrecasteaux, Beautemps Beaupré, Duperrey, Dumont d'Urville, Daussy—to mention but a small number of those who are no more.

"Our existing hydrographical collections count more than 4000 charts. Deducting from this number those which the progress of exploration has rendered no longer available, there remain about 2600 charts in use.

"Of this number more than a half represent original French surveys which foreign nations have in great part reproduced. Of the remainder the general maps are the result of the labours of discussion carried out at the marine depôt where all documents, French as much as foreign, were utilised, and relatively few of them are the expressions pure and simple of foreign labours. Our surveys are not limited to the coasts of France and its colonies. There is hardly a region on the globe for which we do not possess original labours: Newfoundland, the coasts of Guiana, of Brazil and La Plata, Madagascar, numerous points of Japan and China, 187 original charts relative to the Pacific Ocean. We must not omit mentioning the fine work of our hydrographical engineers on the West coast of Italy, which was honoured by the International Jury with the grand medal of honour at the universal exhibition of 1867. The exclusive use by mariners of the meridian of Paris is grounded on considerations of a past of 200 years such as we have briefly recalled.

"The adoption of another prime meridian would involve a change in the graduation of the 2600 charts of our hydrography, would involve a similar change in our maps for nautical instruction numbering over 600, and would of necessity entail a corresponding change in the *connaissance des temps*.

"These are considerations deserving to be pondered. Well, if under these conditions the projected reform, instead of being inspired by the high principles which should govern this subject, is to take for its basis simply a regard for the use and wont of the largest number and their exemption from all sacrifice, reserving for us exclusively the burden of change and the abandonment of a dear and glorious past, are we not, then, justified in saying that a proposal formulated in this sense would not be acceptable?

"When at the end of the last century France established the metre, did she proceed in this way? Did she, as a measure of economy, and not to change anything in her habits, propose her foot-rule to the world? You know the facts. The truth is, we turned everything at home topsy-turvy—habits and material. And the measure chosen related, as it is, only to the dimensions of our globe, is so well disengaged from every French tie that in future ages the traveller who will trample on the ruins of our cities will be able to ask himself by what people was invented the metrical measure which his feet may chance to light on.

"Permit me to say that it is in this way a reform is established and rendered acceptable. It is by setting oneself the example of self-sacrifice and by completely effacing oneself in his work that resistance is disarmed and that a sincere love of progress is attested.

"I hasten to say that I am persuaded that the proposal voted at Rome was neither made nor suggested by England, but I doubt whether, if accepted, it will render a true service to the English nation. An immense majority of the sailors of the globe navigate with English charts, it is true, but it is a homage of fact rendered to the great maritime activity of this nation. The day, however, when this supremacy, freely accorded, is changed into a supremacy official and imposed, it will undergo the vicissitudes of every human power, and this institution, which by its nature is of a purely scientific order, and to which we desire to assure a long and peaceable future, will become an object of keen and jealous rivalry among the nations.

"All this shows how much wiser it would be to take for the origin of terrestrial longitudes a point determined by purely geographical considerations. On our globe nature has so distinctly separated the continent on which the great American nation are now developing themselves that from a geographical point of view there are but two possible solutions, both very natural.

"The first solution would consist in returning to the solution of the ancients with a little modification, by placing our first meridian towards the Azores; the second in relegating it to the immense straits separating America from Asia, towards the confines of the north, where the New World reaches out a hand to the Old.

"These two solutions may be discussed, as they have often and again quite recently been by one of our ablest geologists, M. de Chancourtois.

"Each of these meridians unites in it the fundamental conditions required by geography, and on which people have always been agreed, when national meridians were eliminated from the debates. As to the determination of the point adopted, the astronomical methods which are now so perfect would furnish it with as a great a degree of exactness as geography would require.

"But what need of a special and costly determination of longitude for a point which may be placed arbitrarily provided it is comprised within certain limits, such as to satisfy the condition, for example, of passing by a strait or traversing an island? It is enough to mark out approximately the point adopted. The position thus obtained will be referred to each of the great observatories, which will be related to one another and chosen for this purpose, and this list of relative positions will constitute the definition of the first meridian. As to a material sign on the globe, should such be wanted, a point by no means necessary, it will have to be placed in conformity with this definition, its place would have to be shifted till such conformity was obtained.

(*To be continued.*)

GUESSINGS AT TRUTH

I.

OLD SPENSER, in his wondrous Allegory, tells us—

"... he, that never *would*,
Could never :—"

We are constantly reminded that we must creep before we can walk. So that we cannot look coldly or sarcastically on

"... budding Genius' earliest essàye,"

provided always that we are sure of the earliness. For there often is a strange resemblance between the erratic first flights of the scientific fledgeling and the habitual evolutions of the time-hardened Paradoxer or of the Paper-Scientist.

Besides the mere dozen or so of really successful Physicists, all that the world seems able to produce at any one time, even in these later years, and whose efforts can at the best be rarely called more than *Guesses*, there is an untold multitude whose *Guessings* are irrepressible. These, unlike some at least of the former, never hide their light under a bushel. From week to week we view with curious awe the increasing piles of pamphlets under which our shelves and table sag, groan, and crack! Let us make an effort, and get rid of some of them. Not to the waste-basket—at least not at once—for there is something in almost every bundle of hay (in the Soudan it is not needles, but bricks and slag), and this is usually worth searching for, were it only in the interests of justice to those who have thus (unconsciously?) hidden them. We take the bundles as they come; many are rotten and can be tossed aside at once, others require more careful scrutiny.

The first we light upon is by our particularly modest contributor John O'Toole.[1] [He does not seem to be aware of the powers of Peroxide of Hydrogen, which (though we did not proclaim the fact) enabled us on a former occasion easily to penetrate his *incognito*. But his secret is safe with us.] His present work is a singularly quaint protest against the modern abuse of elementary dynamical terms, and as such is well worthy of careful perusal. There can be little doubt that, of all physical subjects, as presented in an elementary form to the beginner, Dynamics is the most repulsive. And it stands at the very threshold. Mr. O'Toole shows the natural working of a clear, logical, mind in the middle of the present chaos. His pamphlet is one which should be read by all; for, though he hits all round and sometimes attacks the very giants of Science, he invariably hits fair as well as hard. It would take a whole article to discuss fully the questions he raises: suffice it to say that the root of the confusion which he so justly exposes is that little, but much-abused word *Force;* and to quote the following pregnant sentence as showing his point of view :—

"When we behold ... a group or sequence of phenomena, we *insert* force among them of ourselves, because we know from experience that if our organism were substituted for the acting or resisting body, we should have the sensation of pressure."

Next we take a couple of smaller, but more ambitious, pamphlets[2] :—in each of which the Past, Present, and Future of the Universe are promptly settled, though the terms of settlement are by no means identical. When we find, however, that Herr Zehnder, in the second sentence of his pamphlet, says that insuperable objections can be raised against the hypotheses of Helmholtz as well as against those of Kant, Herschel, and Laplace, *because they take too little account of the existing laws of mechanics*, we begin to understand him; and we have only to turn over a few pages to find him thoroughly revealed. His bugbear is the Dissipation of Energy :—and he informs us that the "Eternal Circulation of Matter"—in virtue of which all aggregations such as the sun will ultimately explode into their former nebulous condition, to recommence their condensation, &c.,—is an immediate consequence of THE PRINCIPLE OF THE CONSERVATION OF LIGHT!

Our rival author sums up *his* Kreislauf as follows :—

"... life, matter, and all things, are the necessary and inevitable outcome of the existence of Space. Space or Room, in any form whatever, must of necessity be a form of force or energy, and all things are just phases or manifestations of the working of this force or energy; the Earth is dissolving in Space like a lump of Salt in Water, but New Worlds are being formed in Suns; this dissolving and forming process will go on for ever; and consequently life will be eternal; ..."

This is a step in advance even of Descartes, with whom Space and Matter were the same. We leave to the reader to judge which of the two has the more grotesquely grinned through the horse-collar, the German Swiss or the Scotsman.

Our next step is a large one, no less than from the Universe to the Atom.[1] The work now before us is a very curious one. The author has hunted widely for his materials, and (very naturally) selects such only as suit his theory. So long as he can utilise Sir W. Thomson or Clerk-Maxwell he does so; but, when he finds their statements incompatible with his theory, he has no difficulty in picking up what he wants from Zeuner, Rühlmann, Deschanel, &c. He seems, however, not to be acquainted with the elaborate work of Athanase Dupré. This is unfortunate, for in it he would have found little difficulty in obtaining whatever he might require. The object of the essay, briefly stated, is to frame a theory of the liquid and solid states, somewhat on the lines of the kinetic gas-theory :—only it seems we must have a mutual force between particles, whose law is something between the inverse 4th and inverse 5th powers of the distance. But somehow the law itself seems to vary with the distance; so that "we must apply the theory of probabilities to determine the potential at any centre due to the surrounding atoms." As a striking instance of Mr. Whiting's extensive range of quotation, we note that he refers, for the sum of a common series (given everywhere in elementary text-books of Trigonometry), to no less august an authority than Riemann in his *Partielle Differential-gleichungen!* We do not venture farther to criticise the work of a writer who can, as a matter of course, invoke such irresistible authorities.

We now come to a whole series of memoirs, tracts, letters, and pamphlets :—usually of American origin :—which deal specially with the vexed question of the Sun's temperature. From these we select one only, as the work of the most persistent, if not the most lucid or successful, of the many mere guessers on this subject.[2] For the others consult Van Nostrand's *Engineering Magazine*, *&c.*, *passim*. Something, if not very much, has been done in this matter in Europe. Pouillet, J. Herschel, Crova, Rosetti, Violle, and others have at all events gone to work in a scientific way :—though (as is obvious from the results of Prof. Langley recently given in our columns) the values obtained by them can be but very rough approximations. A few of Mr. Ericsson's weightier sayings will pretty well show the value and character of his treatise. At p. 58 we are told that

"... the actinometer merely shows the thermometric interval of solar intensity on Fahrenheit's scale, without reference to the position of that interval on a scale which commences at the accepted 'absolute zero.' I regard this absolute zero, however, as an *ignis-fatuus*, retreating as fast as we approach it."

[1] *Ausa Dynamica*. Dublin: Hodges, Figgis, and Co., 1884.
[2] *Ueber die Entwickelung des Weltalls und den Ewigen Kreislauf der Materie*. Von L. Zehnder. Basel, 1885.
On the Future of Life and the Universe, according to Science. Dundee: W. A. Drummond, 1383.

[1] *A New Theory of Cohesion*, &c. By Harold Whiting. (Cambridge, U.S., University Press, 1884.)
[2] *Solar Heat (an Extract from a work on "Radiant Heat")*. By John Ericsson. New York, 1885.

The little kinematical, or rather quasi-corpuscular, *excursus* to which pp. 71–74 are devoted, is one of the richest pieces of *paradoxing* (in De Morgan's sense) that we have ever met with. Here is a little bit of it:—

"Pouillet, having ascertained the number of thermal units imparted to the water in his pyrheliometer of 3·93 ins. diameter, imagined that he had measured only the energy of the rays contained in a pencil of 11·9 square inches section; whereas, in reality, he had, at the end of his experiment of five minutes' duration, subjected his instrument to the action of the entire number of rays contained in a passing pencil or sunbeam, the section of which we ascertain by multiplying the orbital advance of the earth during five minutes, 28,836,000 ft., by the diameter of the pyrheliometer, 0·305 ft."

Thus it is the *number* of rays, not the time of exposure to one ray, which determines the result!

One more quotation, a very short one, must be given. It is from p. 136, and we put two words in italics:—

"In view of the fact that projectile force *diminishes inversely* as the square of the depth of the medium penetrated. . . ."

It is not easy to fix on the exact meaning of this very curious statement. Hence we must take it literally, whatever be the consequences. Discussion of penetration would obviously be useless in such a case, for the whole projectile force (even were it infinite) would be gone before penetration had commenced!

The immense expense which has been lavished on this volume, and on its truly wonderful illustrations, is calculated to produce reflections even more painful than those evoked by the perusal of the text itself. From the materials here given, *something* may yet be made, but certainly not on the lines chosen by the author.

We hope, shortly, to return to our store, and to select for the instruction and warning of our readers a few additional specimens, by no means inferior in quality to those just dealt with. G. H.

PROFESSOR FLEEMING JENKIN, LL.D., F.R.S.

ON Friday last, most unexpectedly and greatly to the grief of all his friends, died Prof. Fleeming Jenkin at Edinburgh, at the age of fifty-two. He had been in somewhat delicate health for a considerable time, but was, as usual, personally directing the engineering operations in connection with telpherage in London and Sussex, and seemed to have greatly gained in health and strength when he started for Edinburgh some days before his death. But blood-poisoning succeeded a slight surgical operation, and his death rapidly followed.

He was born in Kent in 1833, and was the son of the late Capt. Charles Jenkin, R.N. His school-days were spent at Jedburgh, Edinburgh, and Frankfort-on-the-Maine, while he took his M.A. degree at the University of Genoa, and began his engineering career in Marseilles, thus acquiring a wide knowledge of languages and of peoples which was most valuable to him afterwards in his scientific and social life.

In 1851 he returned to England, and was apprenticed to Messrs. Fairbairn's in Manchester, from which time his progress was rapid. We hope that the interesting and highly creditable history of his subsequent introduction as a well-trained mechanical engineer to submarine telegraphy (then in its extreme youth) and to Sir William Thomson, which led to his soon taking charge of the testing of the first Atlantic cable in 1858, and to a friendship and partnership with Thomson and Varley, will yet be told by some one who can do full justice to it. Our grief at Varley's loss is yet fresh, and we deeply sympathise with Sir William Thomson at the close of this partnership, the existence of which has been synonymous with the progress of submarine telegraphy.

On the appointment of the Committee of the British Association on Electrical Standards Jenkin's services were solicited, and the good work that he did as a member of this Committee is amply shown by his large contributions to the Reports on Electrical Standards, and which contain an account of his absolute measurement of the capacity of a condenser, the first such determination ever made; and the chapters that he wrote in connection with these Reports on the subject of "Absolute Units" formed the only available text-book for the student of mathematical electricity before about the year 1872. Appended to these reports are the Cantor lectures which he delivered on the construction, laying, and testing of submarine cables, and these lectures showed as wide an acquaintance with the practice of electrical science as do the other chapters referred to with the theory of the subject.

In 1865 he was elected a Fellow of the Royal Society and Professor of Engineering in University College, London, and in 1868 he became Professor in the University of Edinburgh, where he created a School of Engineering to which considerable numbers of prominent Engineers and Professors of Engineering acknowledge their indebtedness. In the following year the Royal Society of Edinburgh elected him a Fellow, and subsequently he became a Member of the Institution of Civil Engineers, having been made an Associate of that Institution as early as 1859. In 1883 the honorary degree of LL.D. was conferred on him by the University of Glasgow.

Jenkin's book on Electricity and Magnetism, published in 1873, was a revelation to non-mathematical and even to many mathematical men, of the ideas which had until then been wrapped up in the mystery of mathematics or in the practice of the submarine cable testing-rooms. Sir William Thomson had been publishing many detached papers on electricity in the mathematical journals, and had been applying his knowledge in practice, so that an exact science of electrical quantities had been growing up among submarine cable engineers; but the electricity of the text-books remained as unscientific and primitive as of old: the knowledge of the practical men had become indeed far more scientific than the knowledge of the schools.

Fully recognising this, Prof. Jenkin made in his book a totally new departure, and presented electricity and magnetism for the first time in a text-book as subjects capable of quantitative study. To understand the great effect produced by this book, which has now passed through many editions, it must be remembered that neither Clerk-Maxwell's treatise, nor Thomson's reprint of his Mathematical Papers appeared until 1873, and that at that time "electric potential," which to-day has its commercial unit, was to every one, except the engineers of submarine telegraphy, a mere mathematical function.

In 1882 a lecture was delivered at the Royal Institution on Electric Railways, and the system devised by Profs. Ayrton and Perry for effecting an absolute block, and thus enabling any number of electric trains to be run without the employment of drivers, guards, or signalmen, was described and exhibited by a working model. An account of this was read by Prof. Jenkin, and he at once saw that it contained the solution of a plan that he had been thinking over for doing on a large scale by electricity what had previously been done on a small scale with pneumatic tubes. *Telpherage*, or the automatic electric transport of goods, was the outcome, and the development of practical methods of running carriers electrically along a steel rod suspended in the air from wooden posts, occupied him, with the other two inventors, during the last three years of his life, the system being one which needed new invention in every one of its details. His inventive power is described by his assistants as wonderfully active and prolific, and he had energetic characteristics which only seldom accompany inventive genius, and which made his cooperation invaluable to the other directors of the Telpherage Company. It is deeply to be regretted that, having busied himself so actively in the long series of telpherage experi-

ments carried out in Hertfordshire, he did not live to see the completion of the first commercial "telpher line" now being erected at Glynder in Sussex.

The building of houses on sanitary principles interested him largely, and the Sanitary Protection Associations in Edinburgh and in London owed their existence to his initiation, and their success was largely due to his constant exertions. His article on "Bridges" in the "Encyclopædia Britannica," his book on "Healthy Houses," and his primer on "Magnetism and Electricity," are well known to scientific readers, but not perhaps to the readers of his numerous articles in the quarterly reviews and monthly magazines, the last of which was his recent article on "Telpherage" in *Good Words*. His numerous scientific papers published since 1864 are to be found in the *Proceedings* of the British Association, the *Philosophical Magazine*, the *Proceedings* and *Transactions* of the Royal Societies of London and Edinburgh, the *Journal* of the Society of Arts, the *American Journal of Science*, and the *Journal* of the Society of Telegraph Engineers.

Technical education much interested him long before it acquired its present interest for the public, and he presided at meetings of the Society of Arts and other societies when papers on that subject were brought forward. As a director of the Watt Institute in Edinburgh for several years he helped to advance technical education in Scotland.

He was an enthusiastic admirer of ability in other men, and he was especially warm in his encouragement of beginners, whether they were his own pupils or not. To gain his help it was only necessary to let him see that it was anxiously wished for, and that the recipient was not likely to make a mean use of it. He had marked dramatic power, and the plays acted in his drawing-room will long be remembered by his friends; while to his conversation, his general reading and wide sympathies gave a charm which was as powerfully felt as it is now regretfully remembered by all who were fortunate enough to know him.

THE GEOLOGICAL SURVEY OF BELGIUM

ALL who are interested in the careful and methodical investigation of the geological structure of the European continent will be sorry to learn that the Belgian Chamber of Representatives has cut down the vote for the prosecution of the detailed Geological Survey of Belgium so seriously as practically to suspend the work. It is miserable to see personal dislikes, religious differences and political antagonism imported into the discussion of a scientific project. Every competent witness must bear testimony to the minute fidelity and conscientious labour with which M. Dupont and his staff have carried out their Survey. If any fault can be found with his maps it is that they are too complete. They give more information than any ordinary reader can assimilate. Each sheet, indeed, is a detailed treatise on the area which it depicts. There are certainly no such elaborately exhaustive maps published in any other country; and Belgium may justly boast that she has led the way in an important advance in the delineation of geological features. It is an open secret, however, that the official geologists have all along encountered the determined opposition of the "géologues libres" who were not so fortunate as to be entrusted with the control of the work. The Survey having been planned by the Liberal Ministry, and being stoutly supported by the authorities, has until now been able to hold on its course. Much time was, no doubt necessarily, spent by M. Dupont in perfecting his system of colour-printing, and the delay in the appearance of his maps, possibly also the difficulty found by the malcontents in understanding them, were used as arguments for a total reorganisation of the staff. The opposition has recently been renewed under the clerical Government now in power, and unfortunately with more success. From the published debate it is clear that the Minister in whose department the estimate for the Geological Map was prepared, and who was officially bound to support that estimate, sat still without speaking in its defence, and the House, taking this silence, no doubt, as an expression of the inclination of the new Government, cut down the vote. We are sure that this retrograde step will be regretted by all who wish well to the progress of science. Into the personal squabbles connected with the subject we have no wish to enter. But as a public act of unwisdom the vote of the House of Representatives will, we hope, be rescinded and the prosecution of the Survey will be again allowed to proceed. If any fault is found with the way in which the map has been prepared, surely the Commission contains talent and energy enough to inquire into this and set matters right without practically bringing the Survey to a stand.

THE CONGO[1]

THESE two welcome volumes from Mr. Stanley testify to the accelerated rate of events in these latter times. It is only twelve years since Livingstone died in the vain search for the sources of the Nile down by Lake Bangweolo, and under the belief that no river but the Nile could sweep past Nyangwe with such a breadth and volume as he found the Lualaba to have. He was not singular in cherishing such a belief; many geographers believed, like him, that the Congo could not fetch such a sweeping circuit, and that the Lualaba must make its way northwards in spite of differences of level and somehow add its waters to the Albert Nyanza. It is only eight years since Mr. Stanley dispersed the delusion, and solved the problem both of the Nile and the Congo; it is just about six years since he began operations as the agent of the International African Association. To judge from the narrative of his journey across the continent, there was no blacker part of the Black Continent than the river banks between Nyangwe and the Atlantic, and no more intractable people than many of the tribes through whom he and his men had to run the gauntlet. Yet already, almost solely by his exertions, this most unpromising region has become "A land of settled government," at least on paper. It has engaged the continued attention of diplomatists from all the great States of the world for months, and is the subject of as many treaties as if it had been founded a century ago.

In reality, however, it is something more than a paper State. No one can read Mr. Stanley's narrative without being convinced that all along the river from Vivi to Stanley Falls there already exists what may fairly be regarded as an organised Government, carried on from some twenty-four stations as centres. But with the merely political aspects of this successful undertaking we cannot deal here. It is certainly an interesting experiment, both from a political and social point of view, this attempt to raise into a State a region not yet redeemed from savagery. What the ultimate result will be it is hard to say; on the one side a great mass of savagery, and on the other the most advanced European influences in politics, in commerce, in industry, in religion. For already we find bands of missionaries everywhere, and as among them are many men of prudence, tact, and ability, Mr. Stanley acts wisely in encouraging their efforts; they will certainly be of service in helping him to accomplish the object he has in view.

Without the aid of the latest applications of science, Mr. Stanley could never have succeeded in accomplishing all he has done in the brief period of six years. Steam has been of infinite service to him, and engineer-

[1] "The Congo, and the Founding of its Free State." By Henry M. Stanley. Two Vols. (London: Sampson Low and Co., 1885.)

ing contrivances in many ways. His flotilla of steamers, some of them most ingeniously contrived for the special navigation of the Congo, may be said to have been everything to him in carrying out his work; and the Congo Free State may be fairly set down as another "triumph of steam." Mr. Stanley claims for the Congo Free State an area of over a million square miles and a population of 42,608,000. As to the area, that is probably not far out; but the population seems to us excessive. Mr. Stanley reaches this great figure by generalising the density which he finds on the banks of the river itself. Between Stanley Pool and Stanley Falls, a distance of about 1000 miles, and including part of the Biyerré and Kwa Rivers, he finds a population of 806,300, and takes for granted that a similar density will prevail throughout the whole of the Congo Basin. This is very unlikely. In uncivilised countries the population naturally crowds itself along the river banks, and it would be very unsafe to calculate on finding regions at a distance from rivers equally well populated. Throughout the whole of the million square miles claimed by the Congo State only a few lines of exploration have as yet been run, though we know that as a whole it is probably the best-watered region in Africa, and possibly therefore the most thickly peopled. But the tendency among African geographers recently has been to reduce previous estimates of the population of Africa, and instead of 200 millions it is thought that 170 millions is one more likely to be nearer the mark. But all estimates, except for districts that have been settled for some time, are necessarily conjectural; and even for Morocco the greatest difference exists between the estimates of different travellers.

On the Lower Congo the Free State has been able to secure only a comparatively narrow strip of territory on the north bank—enough, however, to give it the right of free navigation between the sea and Vivi, where the first series of cataracts begin. From Vivi upwards to Manyanga the State possesses territory on both sides, when France comes in and claims the whole of the right bank of the river to the Likona tributary in 1° S. lat. Thence the Free State expands into boundless and unknown regions, which we hope it will do its best to explore and open up to science as well as to commerce. The aim in the north has been evidently to draw the boundary of the

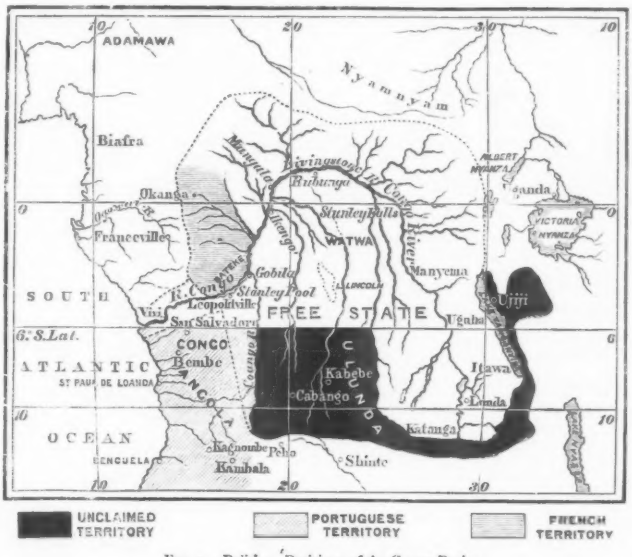

FIG. 1.—Political Divisions of the Congo Basin.

State between the basins of the Nile and the Congo. The western basin of the Upper Nile, no doubt, is fairly well known, but the region between that and the Upper Congo is just that part of Africa about which we know scarcely anything. The boundary on this side, therefore, has been drawn with the freedom of conjecture. All the rivers that are not known to send their waters to the Nile must, in Mr. Stanley's opinion, come down to the Congo, or, at least, ought to do so, and are made to conform with Mr. Stanley's idea of what is right and proper, in the large map which accompanies his work. In spite of Dr. Junker's discovery of the water-shed which separates the Nepoko from the Welle, they are both made to send their waters southward to swell the magnificent Aruwimi. This may be so; only actual exploration will decide the matter. It is mainly to settle this question that Dr. Lenz is preparing to proceed to the Upper Congo as leader of an expedition into the region that lies between that region and the Upper Nile tributaries. And here we have one very beneficial result of the work which Mr. Stanley has done on the Congo. His numerous stations form so many starting-points for further exploration. They can be easily and rapidly reached from the West Coast, and through the agencies at their command, all the men and goods obtained necessary for the conduct of an expedition into the interior. If every station on the river were made the basis of further exploring work, one of the greatest blanks in our knowledge of Africa would soon be filled up. In the interest of the enterprise itself this must be done. If the manifold products of the wonderful land over which Mr. Stanley is so enthusiastic are to be brought down to the river for shipment to the upper terminus of the future railway that is to convey them past the cataracts, it is evident that station after station must be pushed on into the interior. Among the white *employés* of the Association are many men of education and intelligence; and while their first duty is to look after the interests of the "Free State," these interests, instead of suffering, are likely to be advanced by a scientific knowledge of the country around the States. Already good meteorological work has been done at Vivi by Dr. Danckelmann, whose recently published

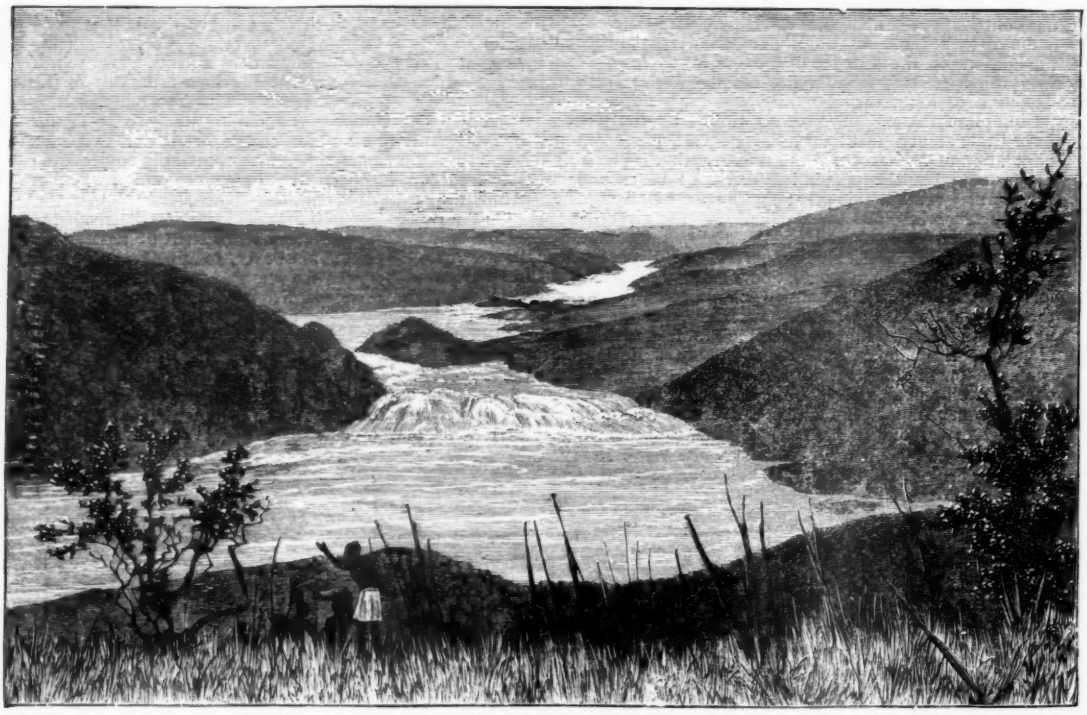

FIG. 2.—Vellala Falls from Left Bank.

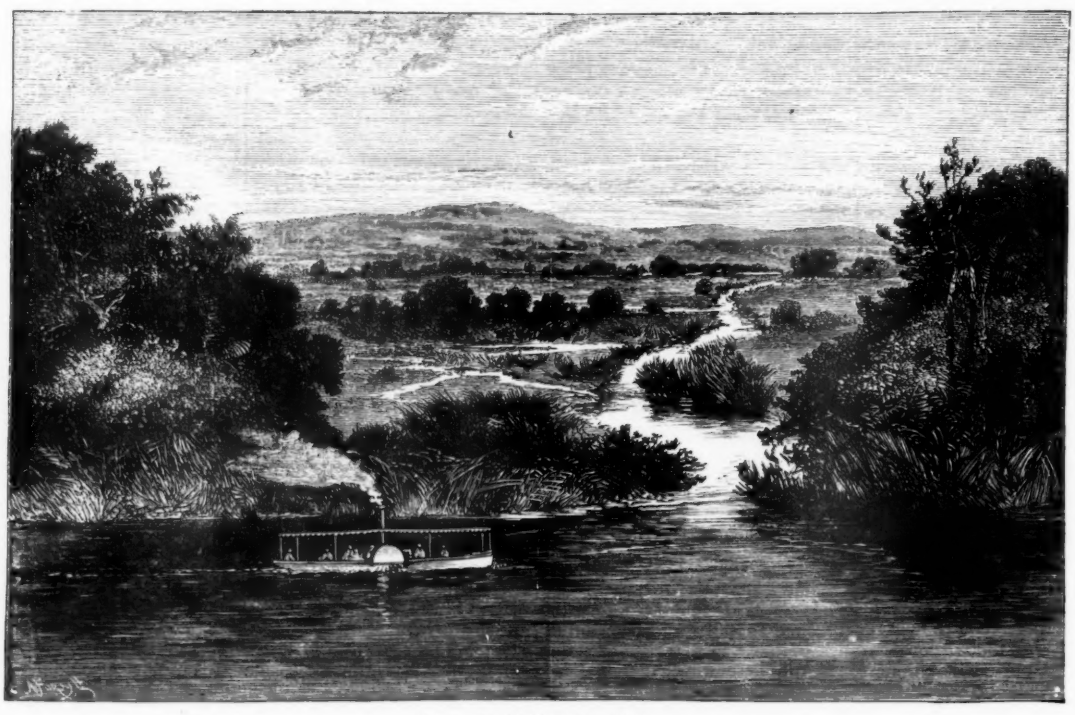

FIG. 3.—Head of Lake Leopold II.

observations we reviewed some time ago. The utility of such observations is evident from the volumes before us. Mr. Stanley makes considerable use of them in his chapters on the Climate of the Congo. These chapters are of much interest; they are written mainly with a view to show that, with reasonable precautions, Central Africa ought to be perfectly tolerable to the European constitution. What these precautions are he describes in minute detail. At the same time he admits that a lengthened residence in such tropical regions must in the end tell on

Fig. 4.—Banks of the Upper Congo.

the Europeans, and is only possible with a run home every eighteen months. Thus it is clear that if the resources of the Congo are to be developed, it must be by native labour, and there is therefore every inducement to treat the population humanely.

Of course, Mr. Stanley himself in his frequent journeys

Fig. 5.—A Type of the Basoko.

up and down the river has added considerably to our knowledge of it. His original sketch of its course, made in one rush downwards, seems, however, to have been wonderfully accurate; though the hundreds of observations as to direction, altitude, depth, and width has enabled him to lay it down with much greater precision. It is to be hoped that the geology of the basin will be well worked out, and even from a "utilitarian" standpoint it might be useful for the Association to engage one or two competent men to work out the geology. The numerous cataracts on the lower as well as on the upper river prove that there is much here to interest the geologist. On the lower river, just where the great central plateau begins to shelve down to the coast, they are to be expected; but what is the exact geological explanation of the numerous cataracts on the upper river and its tributaries, as far south as Bangweolo, let us hope, will ere very long be explained. The banks of the river itself are in many places remarkably picturesque; indeed Mr. Stanley would make us believe that he thinks no other river is equal to it in this respect. Magnificent bluffs, he tells us, are met with in many places, and gorges that are almost *cañons*. At Stanley Pool and elsewhere the river has broadened out into lake-like reaches studded with islands, and at one place a few miles south of the equator there is a complicated offshoot of lakes and streams which reminds one of what is observed in so many places on the Central and Lower Amazon. This stretch has not, however, been completely explored, though Mr. Stanley's account of his journey up the Kwa and Mfini to Lake Leopold is one of the most interesting chapters in the volume. The Kwa discharges at about 3° S. lat., and Lake Leopold, Mr. Stanley joins conjecturally to Lake Montumba, which is connected with the Congo at about fifty miles south of the equator.

With regard to the volume of discharge of the Congo, from careful observations made at Stanley Pool, Mr. Stanley calculated that it reached 1,436,850 cubic feet per second when the river at that point was at its lowest. During flood it rises, he believes, twelve feet higher, giving a volume of 2,529,600 feet per second. If these estimates are correct, then Mr. Stanley calculates that the river discharges into the sea three million cubic feet of water per second.

Mr. Stanley's new work is so fully occupied with the details of the founding of his numerous stations, his dealings with chiefs and people, his road-making and other engineering enterprises, and the general work of engineering the enterprise, that there is little space left for geographical details. He does give a list of the products of the Upper Congo region, but as this is entirely from a commercial standpoint, its value to science is not great. The various species of palms, as might be expected, abound on the banks of the river and its islands, the oil-palm being the most valuable from a commercial point of view. Then come the various species of india-rubber plants, besides other gum-producing trees. Ivory, Mr. Stanley reckons only fifth in rank among the natural products of the Congo. He presumes that there are

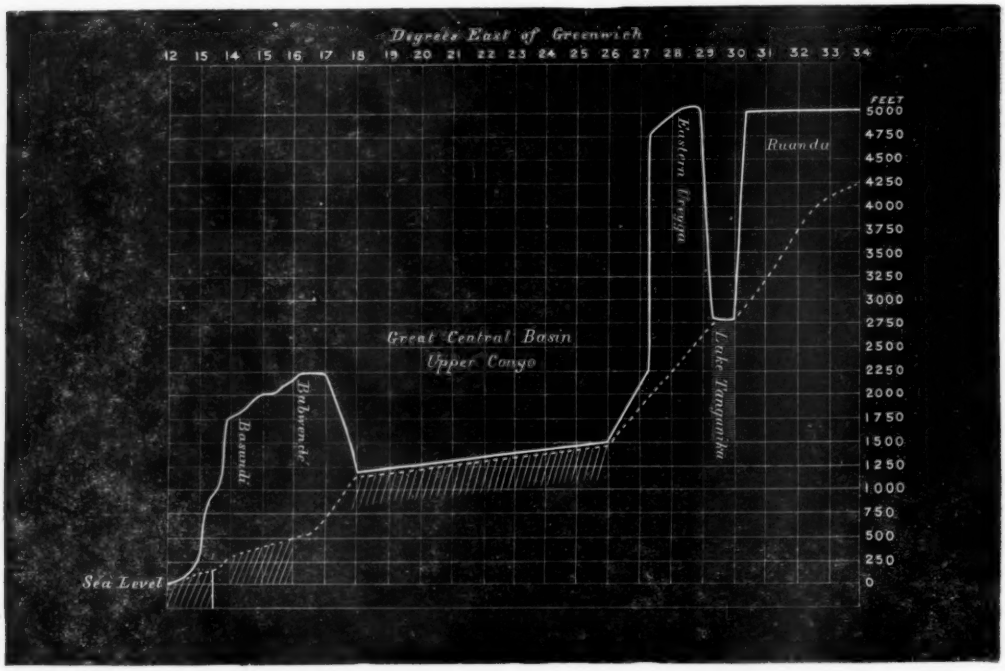

FIG. 6.—Profile of Country between the Sea and Ruanda, across the Congo Basin.

almost 200,000 elephants in about 15,000 herds in the Congo basin, each carrying an average of 50 lbs. weight of ivory in bis head. Iron, he tells us, is abundant. The copper mines near Philippeville supply a large portion of Western Africa with their ingots. Plumbago is also abundant, and gold has been found in the beds of streams. Mr. Stanley gives a long list of tropical plants which abound in the Congo basin, while several European vegetables and fruits have been found to thrive. The Arabs, moreover, he tells us, are introducing the large-grained upland rice with extraordinary success. He adds many details concerning the trade, actual and possible, of the Congo region, his object, of course, being to show that here exists a magnificent field for the European trader, European capital, and European settlers.

Mr. Stanley's work is chiefly of value as telling the story of one of the most unique and interesting enterprises on record. This story he tells with abounding interest; there are many incidents throughout the volume told with the dramatic effect so well known to readers of "Through the Dark Continent." The work of founding the Free State has been well begun, but it is only the beginning; for the sake of its complete success it is to be hoped that nothing may occur to sever Mr. Stanley's connection with it until it has been firmly established.

NOTES

THE Royal Society's *conversazione*, held on the evening of June 10, was a very great success, and those who had the labour of bringing together various things together must have felt themselves amply rewarded by the great interest taken in them by the Fellows and guests, both ladies and gentlemen, who attended. Among the objects exhibited we may note the following:—Geological map (unpublished) of Palestine and Arabia Petræa, exhibited by Prof. Edward Hull, F.R.S.; original drawings of the skeletal, digestive, and vocal organs of birds, made in the years 1842-46, drawn and exhibited by Prof. W. K. Parker, F.R.S.; Sketches of the eclipse of the moon, October 4, 1884, and a very beautiful series of sketches of the wonderful sunsets and after-glows, painted and exhibited by Mr. W. Ascroft; star-charting by photography (enlarged prints from negatives made in 1883 and 1884), exhibited by Mr. A. A.

Common, F R.S. ; electrical influence machine, exhibited by Mr. James Wimshurst ; New microscope with novel fine adjustment and sub-stage arrangements, exhibited by Mr. Crouch ; large Nicol prism polariscope, for projecting axes of crystals, &c., on the screen (improved form), exhibited by Messrs. Harvey and Peak ; Tate's calculating machine, exhibited by the inventor. By means of this machine long operations in the fundamental rules of arithmetic can be performed with rapidity and unfailing accuracy. Eight figures can be multiplied by eight figures in about fifteen seconds. New forms of spectroscopes, exhibited by Mr. A. Hilger ; photographs of fractures of railway carriage and waggon axles, tested to destruction by Mr. Thos. Andrews, Wortley Iron Works, near Sheffield, exhibited by Mr. Andrews ; three cases of living animals : (1) Examples of the Tuatera (*Sphenodon punctatus*) from New Zealand. This reptile is remarkable as deviating from all the lizards in its osseous structure, and is considered by Dr. Günther (*Phil. Trans.*, 1867, p. 620) to constitute an order by itself—*Rhynchocephalia*. (2) Large bird-eating spider of the genus *Mygale* from Burmah—probably *M. fasciata*. (3) Butterflies and moths, showing the way in which living insects are exhibited in the Zoological Society's Insect House, exhibited by the Zoological Society of London. A series of microscopic sections of vegetable tissues, prepared and lent by Mr. J. E. Sunderland, of Hatherlow, near Stockport, showing remarkable effects of double and triple anilin staining ; a series of botanical microscopic preparations, mounted by Charles Vance Smith, of Carmarthen, being part of a series prepared by him to illustrate the text-books of Julius Sachs and Otto Thomé, exhibited by Prof. Moseley, F.R.S. A series of slides with stained specimens of *Tænia echinococcus* of the dog, prepared and lent for the occasion by Dr. J. Davies Thomas, of Adelaide, Australia, in illustration of his paper on the artificial rearing of this parasite by feeding with human hydatids (to be read before the Royal Society, June 18) ; a slide showing the same species of tape-worm, reared by Mr. Edward Nettleship, F.R.C.S., by means of hydatids obtained from the lungs of a sheep (*Proc. Roy. Soc.*, 1866). To compare with the above :—Specimens, in bottles, of *Tænia serrata*, *T. marginata*, and *T. cænurus*, &c., artificially reared by Dr. Cobbold, by feeding dogs with the scolices appropriate to each particular species. Also adult examples of *Tænia cucumerina* and of *T. canis lagopodis* (*T. litterata*), the latter from Iceland, prepared by Dr. Krabbe, *Bothriocephalus dubius*, and other species from the cat and dog, exhibited by Dr. Cobbold, F.R.S. Case of gems, including a great Indian diamond, the largest known opal, a series of cat's eyes, and allied mineralogical specimens, exhibited by Mr. Bryce Wright, F.R.G.S. ; "Frith's Selenium Cells," showing the alteration of resistance and photo-electric currents due to the action of light on selenium, exhibited by Prof. W. Grylls Adams, F.R.S ; a sulphur cell, the electrical resistance of which, like that of selenium, is reduced by light, exhibited by Mr. Shelford Bidwell. The sulphur has been heated while in contact with silver, and therefore contains some sulphide of silver. The electrodes are of silver. The original integrating machine, invented by Mr. C. V. Boys ; engine-power meter which has been developed from the same, exhibited by Mr. Boys.

We give in another column, on the *audi alteram partem* principle, the first part of an address recently given by Dr. Janssen, putting before us the French view of the Prime Meridian question. It will be gathered from it that the feeling in France is strongly against the conclusion at which the Washington Congress arrived. Taking the world as it is, however, much as a strictly neutral prime meridian might be to be desired, the general opinion will probably be that the Congress arrived at the only *practical* solution.

We are glad to see that University College, Liverpool, is about to appoint a Professor of Engineering. An endowment of 375*l.* has been raised, and the advertisement of the Chair appears this week in our pages. We understand that a certain amount of professional work, such as is consistent with a due fulfilment of the duties of the Chair, will be permitted, and recognised as enabling the Professor to keep himself in touch with the life of the practical world. The College already has endowed Chairs of Mathematics, Physics, Chemistry, and Biology, in addition to the Literary and Medical Departments : it has lately become a part of the Victoria University, and in many ways it shows signs of health and vitality.

In the production of the first part of the Philological Society's new English Dictionary, the editor, Dr. Murray, was obliged to advance 150*l.* out of his own resources, and, further, to incur a debt of 500*l.* The delegates of the Clarendon Press, who are publishing the Dictionary, decline to contribute more than 100*l.* towards the payment of this debt, and the Council of the Philological Society deem it their duty, therefore, to appeal to the public to relieve Dr. Murray from a debt incurred on behalf of what is really a national undertaking. It is to be hoped that there will be no difficulty in obtaining the sum required ; those of our readers who are inclined to help should send their subscriptions to Mr. Benjamin Dawson, the Mount, Hampstead, London, N.W.

The Spanish Commission of Medical Inspection has examined the composition of the liquids and virus employed by Dr. Ferran against cholera. The opinion of the majority of the members is that the presence of Koch's *Bacillus virgulus* cannot be questioned. After some opposition, the Spanish Government granted the necessary authorisations for inoculation, which has been practised on a number of doctors and four newspaper writers. It is said, moreover, that all the inoculated patients experienced during the first twenty-four hours after the operation all the symptoms of cholera with more or less intensity, but without any fatality having occurred. When twenty-four hours had elapsed, a favourable reaction took place. The question which remains to solve is the extent of the protection resulting from Dr. Ferran's system. The numbers given are in favour of the new theory, but all the documents coming from Spain on cholera must be received with caution, owing to the intense panic prevailing in that country since the last outbreak of the plague was noticed in Valencia. A fact curious to notice is the tendency of the rural populations of this province to congregate in the cities in spite of all the measures taken against this exodus. *El Imparcial* states that not less than 7000 people have located themselves in the chief city.

Prof. Pasteur, the *Standard* Paris correspondent states, has published an interesting letter from Dr. Ferran, concerning vaccination for cholera. In this letter Dr. Ferran asserts that the results obtained become every day more irresistibly eloquent. The experience of Alcira had been confirmed in numerous other towns. Anti-cholera vaccination had been practised upon all classes of society, but in many places the greater number of those operated upon belonged to the pauper class, and the results proved no less satisfactory. While of opinion that one inoculation is effective, Dr. Ferran recommends that it be repeated, in order to make assurance doubly sure. In reference to the official prohibition of vaccination for cholera (which has since been cancelled in deference to public opinion), Dr. Ferran intimates that the measure was taken in consequence of two persons belonging to an already cholera-visited family dying the day after vaccination. These casualties Dr. Ferran attributes to the use of impure lymph, and states that in 16,000 cases, for which he had personally inspected the lymph, no evil results had followed. It is

not claimed that vaccination for cholera will give actual immunity, but that it will alleviate the attack whenever it may come. Anti-cholera vaccination, affirms Dr. Ferran, can never itself be the cause of an attack. If an attack comes within five days of vaccination it must have been previously contracted. Dr. Ferran attributes the discovery of anti-cholera vaccination to the theories of Prof. Pasteur.

Dr. Cornish, known for his investigations into the nature of cholera, has proposed (according to *Allen's Indian Mail*) that as between 300 and 400 persons are every year judicially sentenced to death in the Indian Empire and its dependencies, a number of these, say one-tenth, be made, with their own full knowledge and consent, subjects of experiments as to the spread of cholera, on condition that if they escape their lives be spared. An international commission of experts might, he suggests, be appointed to determine upon the experimental tests needed to ascertain if cholera is or is not a disease capable of being communicated from person to person. This would do more in the space of a few months to help forward the inquiry into the nature of cholera than has been accomplished by indirect observation during the last century. But if the principle underlying this proposal is admitted by the Indian Government, it might be extended to other most important experiments, such as the various causes and cure of cholera, the cure for snake-bites, hydrophobia, and the like.

The following is an official statement of the number of visitors to the Whitechapel Fine Art Exhibition during the time it was open in March and April last:—Saturday, March 28, 1008; Sunday, March 29, 2494; Monday, March 30, 2622; Tuesday, March 31, 3332; Wednesday, April 1, 3292; Thursday, April 2, 1823; Good Friday, April 3, 3703; Saturday, April 4, 3269; Easter Sunday, April 5, 2717; Easter Monday, April 6, 4332; Easter Tuesday, April 7, 3720; Wednesday, April 8, 2944; Thursday, April 9, 2872; Friday, April 10, 1942; Saturday, April 11, 3348; Sunday, April 12, 3345; total for 16 days; 46,763. The Exhibition was opened in the afternoon of March 28, admission being by ticket only until 6 p.m., 6 to 10 p.m. free; after that it was opened free from 10 to 10 daily (Sundays 2 to 10).

At the meeting of the International Committee of Meteorology (instituted by the Congress held at Rome) in the beginning of September next, at Paris, the following topics will be considered:—Report of the Secretary on the work of the Committee since the Copenhagen meeting; report of MM. Brito Capello, Hildebrandson, and Ley on the observation of Cirrus; Should a third International Congress be convoked? the establishment of stations of the first order on the Congo; discussion of the meteorological *résumés* issued in different countries, and eventual preparation of a more uniform plan; the utility of American meteorological telegrams proposed by Gen. Hazen, and organisation of their distribution in Europe; best means of securing the timely reception of meteorological telegrams; ought barometric heights to be reduced to the pressure under 45° of latitude? Should meteorological hours be reckoned from 1 to 24 in conformity with the resolution of the Washington Conference? Designation of a completely covered sky as to the form of clouds; definition of days of rain and snow; should not a uniform height above the ground be recommended for pluviometers? recent progress in the more exact measurement of snow; international meteorological tables; modification of the rules for administration of the International Meteorological Committee. Communications should be addressed to Mr. R. H. Scott, F.R.S., Meteorological Office, 116, Victoria Street, London, S.W.

In a communication to the Physical Society of Berlin, on April 24 Herr Kayser read a note concerning his experiments on the condensation of gases on surfaces, and Bunsen's criticisms thereon. In a paper published last year Bunsen had declared that the previous results under this head were erroneous, inasmuch as the observers had proceeded upon the false assumption that a maximum of condensation was attained in a few hours or days, Bunsen himself finding that the condensation might go on slowly for years. Herr Kayser, however, had, in reply, pointed out that Bunsen had not been sufficiently careful in cleaning the glass surfaces on which his experiments were made, and he now had the satisfaction to announce that Bunsen, after repeating his experiments with the necessary precautions, had arrived at the same conclusion as himself, namely, that there was no demonstrably slow condensation, but that the maximum of condensation was reached with extraordinary rapidity.

The project to build a "Grassi-Museum" has now assumed a tangible shape at Leipzig, inasmuch as the site for the new museum has been chosen. The new museum is to contain the collections belonging to the Ethnographical Society, which are now crammed into premises entirely unsuitable for them.

Dr. Otto Zacharias has recently made interesting researches concerning the freshwater fauna of the Silesian Riesengebirge and the county of Glatz. The Royal Prussian Academy of Sciences has just granted him a sum of money towards the continuance of his labours.

Mr. Howard Newton, assistant municipal engineer, of Singapore, has published a series of notes and experiments on the different kinds of timber in ordinary use in the Straits Settlements. The pamphlet contains observations on the forests adjoining our colonies in the Malay Peninsula, and the need already of conservation. The trees are felled in large numbers for ordinary use, and the jungles are cleared and exhausted by the Chinese gambier and pepper planters. Twenty specimens of woods are then described in detail, and finally an account of the mode in which the experiments were conducted and elaborate tables of the results follow. The breaking weights of some of the timbers tested were as follow:—1850, 1836, 1656, 1374, 1286, and 1284 lbs. Notes on the toughness, fracture, deflection, &c., are also given. It is curious to notice that some of the finest trees near Singapore (in the Johore forests) have no botanical equivalents. Mr. Newton specially mentions a tree called by the Malays the *ballow*, which grows from 60 to 100 feet in height, with a diameter of 3 to 6 feet. It is a close-grained, tenacious, hard, heavy wood, very valuable for building. It is called popularly Johore teak, although it does not belong to the natural order *Verbenaceæ*.

The Russian Geographical Society has awarded a gold medal to M. Klossowski for his work on thunderstorms in Russia. We take the following from M. Rykatcher's analysis of this remarkable work. The initiative of thunderstorm observations having been taken by the Geographical Society in 1871, no less than 1821 regular observations were made during the years 1873 to 1882 at 176 different stations. For 145 of them annual and monthly averages were calculated, and gave the following interesting results. The minimum of thunderstorms (5 to 7 per year) is found in the north; their number increases towards the Gulf of Finland (with a depression south of it) and on the middle Volga, where it reaches 12 to 15 per year, and remains nearly the same throughout middle and southern Russia, with a slight decrease in the Crimea. A rapid increase in the number of thunderstorms is found in Western Russia, especially in Bessarabia (33 at Kishineff), as also in the East, at Tamboff, Penza, and on the Lower Don. The maximum of thunderstorms, 41 per year, is found at Tiflis. As might be expected, the thunderstorms are more frequent where the summer rains and the relative humidity are the greatest. Their diurnal maximum is between

3 and 6 p.m., and the minimum between 3 and 6 a.m. Availing himself of the synoptical maps of Hofmeyer for 1874 to 1876, the author compares, day after day, the thunderstorms with the cyclones which reach Russia, and he arrives at the important conclusion that thunderstorms in Russia—without exception—accompany cyclones, their appearance being influenced at the same time by the local state of temperature and humidity. Marié-Davy, Mohn, and others subdivided thunderstorms into cyclonic and local ones, and the continental ones were reckoned to the second category; but M. Klossowski shows that even in so continental a climate as that of Russia, thunderstorms depend also directly on cyclones. They appear on the borders of the cyclones and mostly in their south-eastern quarters. By further researches, the author arrived at the conclusion that thunderstorms in Russia are secondary or tertiary cyclones appearing on the borders of a cyclone, and thus explains the oscillations of the barometer during thunderstorms, already noticed by Messrs. Scott, Mascart, and others. Hail is obviously closely connected with thunderstorms. It also accompanies cyclones and is always concentrated in its south-eastern quarter, in the zone of 750 to 760 millimetres' pressure. On the whole, the work of M. Klossowski is a valuable contribution to the study of electrical energy in the atmosphere.

In a lecture delivered in the Institute of the Khedive at Cairo, Dr. G. Schweinfurth has given some account of the seats of manufacture of prehistoric stone implements in the desert of Eastern Egypt discovered by him in 1876 and 1877, and again visited and examined by him in his last journey. The two spots referred to are in the Wadi Sanur and Wadi Warag. The former lies due east of Beni Suef at a distance of thirty miles from that town; the latter is in the upper portion of the Wadi at the place where this water-course begins to be discernible as a longitudinal depression on the heights of the western part of northern Galala. Dr. Schweinfurth's belief that the two sites in question are really those of ancient manufactories of stone implements is grounded partly on the presence of accumulations of cores in the beds of the streams, partly on the fact that the raw material is found abundantly in the neighbourhood. The source of the raw material is a bed of flints belonging to the upper nummulitic limestone corresponding to that which exists behind Cairo. Implements and utensils indicating a stone period have now, Dr. Schweinfurth remarks, been found even in the very heart of Africa, and these show a surprising resemblance in form to those discovered in Europe. Those recently obtained by himself from Sanur and Warag, however, are of a special type, and Dr. Schweinfurth regards them as clearly distinguished from the forms already familiar by the fact that the facets are usually only upon one side and are very seldom seen surrounding the entire core.

In connection with the trial of Pel for poisoning, which has just resulted in Paris in the condemnation of the accused, some interesting experiments were conducted at the Morgue with a view to testing whether it was possible, as alleged by the prosecution, that the murderer could have got rid of the body of one of his victims by burning it piece by piece in a common stove. The professional witnesses stated that they procured a body weighing sixty kilogrammes. They removed from it forty kilogrammes of organic matter, and lighted a fire of wooden logs. They thus ascertained that in an hour the complete reduction to ashes of one kilogramme of organic matter could be effected, and in forty hours the complete combustion of a body weighing sixty kilogrammes could be completed. The accompanying smell was not disagreeable. The bearing of this on the question of cremation is obvious. It is possible to consume the human body by fire at a comparatively small expense, as these experiments show. In Japan, where cremation has been practised for ages, the quantity of wood consumed in the cheapest cremation is so small that European doctors doubted the evidence of eye-witnesses. Cremation of the lowest class costs only two shillings, on account of the small quantity of wood used, and the operation generally lasts from six to nine hours. The smell for a considerable distance around the crematorium is, however, of a very offensive kind, and the accessories are, as a rule, far from agreeable. There is, however, no doubt that the body can be consumed at a far less expenditure of fuel than is generally considered possible.

The following appears in the *Times*:—Last autumn, a bookseller named Meyer, of Ronneburg, tied a water-proof label under the wing of a swallow which had occupied a nest at his house, and had become comparatively familiar. On it he wrote a query in German to the effect that he wished to know where the swallow would pass the winter. The bird returned to its former nest bearing an exchange label similarly fastened, saying, in German also, "in Florence, at Castellari's house, and I bear many salutations."

The Austrian Government has refused to authorise the establishment of private cremation societies, on the ground that they might encourage crime. The decree states that murders are often detected by the exhumation of bodies, and that, even if bodies were to be examined before cremation, there would be no time to apply in every case those delicate chemical tests which are used where poisoning is suspected.

A telegram from Tiflis states that a severe earthquake has occurred in the Eastern Caucasus. The town of Sikuch is said to have been completely swallowed up. The loss of property is estimated at several million roubles.

The latest telegrams from India state that the Cashmere earthquakes continue to occur with increased severity. It is reported that 2280 persons have perished in the district of Muzufusabad.

Information has been received at the Hague from Java that the state of Krakatoa was causing some anxiety. Towards the end of April subterranean sounds were heard in the neighbourhood day after day, and flames arose from the crater. The rocks which emerged from the sea during the last eruption suddenly disappeared.

From a report of Mr. H. Walker, Commissioner of Lands of British North Borneo, it appears that gold exists in considerable quantities in that territory. Some natives had brought a little to Sandakan, and Mr. Walker set out to verify its existence in the Sagama district. He searched thirty or forty different places and found gold at almost every place, generally in small distinct specks, large enough to be gathered with the fingers, sometimes larger, and always in conjunction with a black metallic dust and iron or copper pyrites. The rocks met with were granite, gneiss, quartz, limestone, jasper, porphyries, red sandstone. Steps will probably be taken to have the whole region thoroughly examined by a competent geologist. The minerals already ascertained to exist in North Borneo are gold, silver, copper, chromium, tin, plumbago, lead, and coal. Antimony and cinnabar are reported. On the west coast chromium, copper, and arsenic have been found; in the neighbourhood of Kinabalu silver ore and pyrites; a sample of native copper has been sent to London; a rich sample of galena and silver, yielding on assay 115 ounces of silver to the ton, has been found. Hitherto the officials of the Company and the other Europeans on the coast have been dependent for local information respecting these and other minerals on the rough statements of natives. It appears certain, however, that, besides its great forest and agricultural wealth, British North Borneo is also rich in minerals—how rich

cannot be said until a thorough examination by an expert has been made.

ACCORDING to the *San Francisco Courier* the great glacier of Alaska is moving at the rate of a quarter of a mile per annum. The front presents a wall of ice 500 feet in thickness; its breadth varies from three to ten miles, and its length is about 150 miles. Almost every quarter of an hour hundreds of tons of ice in large blocks fall into the sea, which they agitate in the most violent manner. The waves are said to be such that they toss about the largest vessels which approach the glacier as if they were small boats. The ice is extremely pure and dazzling to the eye; it has tints of the lightest blue as well as of the deepest indigo. The top is very rough and broken, forming small hills, and even chains of mountains in miniature. This immense mass of ice, said to be more than an average of a thousand feet thick, advances daily towards the sea.

IT is contemplated to use the electric light in Algiers for night work during harvest time, in order to escape the heat, which is almost murderous for Europeans, and is an obstacle to their carrying on agricultural work.

THE borings undertaken for scientific purposes in the shaft situated near the railway station of Koetzschau, about five miles from Lützen (Germany), have now reached the depth of 1500 metres. Observations of temperature are now being made in the shaft.

THE Norwegian Government has voted a sum of 50*l.* to Dr. O. J. Olsen for the prosecution of his studies of wild edible mushrooms.

THE education of girls in Russia does not appear to stand very high. According to the *Moskow Viedomoski* only 21 children out of 100 attending school were girls. The proportion varies with the religion. Thus, of Protestants the number was greatest, viz. 45·4 per cent.; of Jews, 34·1 per cent.; and of Roman Catholics, 14·4 per cent. The number is lowest amongst Greek Catholics, viz. 12·3 per cent.

THE additions to the Zoological Society's Gardens during the past week include a White-fronted Capuchin Monkey (*Cebus albifrons* ♂) from South America, presented by Mr. E. Luxmore Marshall; a Macaque Monkey (*Macacus cynomolgus* ♂) from India, presented by Mr. A. R. Brown; a Martinique Gallinule (*Ionornis martinicus*), captured at sea, presented by Mr. G. S. Webb; two Grey-breasted Parrakeets (*Bolborhynchus monachus*) from Montevideo, presented by Miss Buist; a Red and Blue Macaw (*Ara macao*) from Brazil, presented by Mr. J. W. Beswick Purchas; a Yellow Conure (*Conurus solstitialis*) from Venezuela, presented by Mr. Albert H. Nicholson; a Barn Owl (*Strix flammea*), British, presented by Mr. W. Ostle; an Æsculapian Snake (*Coluber æsculapii*) from Central Europe, presented by Miss Lenox Conyngham; a Domestic Sheep (*Ovis aries*, var. ♂) from Somali Land, deposited; two Larger Tree-Ducks (*Dendrocygna major*) from India, two Gould's Monitors (*Varanus gouldi*), two Great Cyclodus (*Cyclodus gigas*), two Carpet Snakes (*Morelia variegata*), three Diamond Snakes (*Morelia spilotes*) from New South Wales, received in exchange; a Japanese Deer (*Cervus sika*), three Pigmy Hogs (*Porcula salvania*), born in the Gardens.

OUR ASTRONOMICAL COLUMN

COMETARY ORBITS.—Prof. J. G. Galle has formed a most useful and very complete catalogue of orbits of comets which have been calculated since the publication of the third edition of Olbers's "Methode zur Berechnung der Cometenbahnen" in 1864. This catalogue appears in Nos. 2665-66 of the *Astronomische Nachrichten*. In one table are collected orbits of comets before 1860, which have been more definitively determined during the past twenty years, with a few orbits of ancient comets computed for the first time or founded upon better data, including those observed by Toscanelli; in a second table are contained the most reliable orbits of all comets discovered since the year 1860. The elements are given in an approximate form only, but in the notes accompanying each table reference is made to the place of original publication. Prof. Galle's *résumé* will be of much service to the student in this branch of a tronomy. It appears to have been drawn up on the suggestion of Prof. Krüger, seeing that there was no immediate intention of publishing a fourth edition of Olbers's celebrated treatise. Five newly-detected comets of short period figure in the second table.

BINARY STARS.—The following calculated angles and distances of several of the more rapidly revolving double-stars will serve to indicate how nearly measures made about the present time are represented by the best available orbits:—

Star	Epoch	Pos.	Dist.	Authority for orbit
		°	"	
ζ Cancri ...	1885·0 ...	62·0 ...	0·93 ...	Seeliger
	1886·0 ...	57·6 ...	0·95	
η Coronæ Bor. ...	1885·5 ...	173·9 ...	0·61 ...	Doberck
	1886·5 ...	182·2 ...	0·65	
ζ Herculis ...	1885·5 ...	90·3 ...	1·49 ...	Doberck
	1886·5 ...	85·3 ...	1·50	
μ^2 Herculis ...	1885·5 ...	285·6 ...	0·80 ...	Doberck
	1886·5 ...	296·5 ...	0·76	

Dubjago's orbit of β Delphini (Burnham 151) gives for 1885·6, Pos. 238°·1, Dist. 0″·28.

TYCHO'S NOVA OF 1572.—Some years since it was shown by Prof. Wolf that this object was observed by Lindauer at Winterthur on November 7, 1572, and it is equally certain that it was seen by Maurolycus at Messina at its meridian transit on the following evening, though there appears to be some confusion between altitude and declination in his published description. It was not seen by Tycho until November 11.

In 1808 the Abbé Scina, in a work printed at Palermo, entitled "Elogio di Francesco Maurolico," referred to his observations of this star, apparently given in the first instance in a special treatise written by Maurolycus (*Judicium de nova stella*), to which Lalande alludes in his Bibliography, and subsequently in 1613 in a life of the astronomer written by his nephew. According to Clavius, Maurolycus thus records his first observation of the star: "Hanc ego stellam in hoc Messanæ horizonte observans in meridiano extantem circa tertiam noctis horam reperi altitudinem ejus essé 62. Unde conjecturam feci eam locari quasi, in summitate circuli arctici, ut distet hic a meo vertice per gradus 28, ac proinde ab æquatore per gradus 66½ fere, quoniam Messanæ latitudo habet gradus 38½, et eam sitam in puncto, in quo colurus æquinoctiorum secat arcticum circulum, aut ipsi puncto vicinissimum."

According to Argelander the place of the star for 1573·0 was in right ascension 0h. 1m. 52s., declination 61° 46′·4; the sidereal time at mean noon at Messina on November 8 was 15h. 49m. 50s., and consequently the star was on the meridian at 8h. 10m. 41s. mean time, or at 8h. 24m. 46s. apparent time, 3h. 24m. after sunset, and, the latitude of Messina being 38° 11′, the meridian altitude was 66° 25′, which was the distance from the equator given by Maurolycus. Nevertheless the Abbé Scina did not agree with Piazzi's suggestion that there was a typographical error in Clavius, and that 61½° should be substituted for 66½°. The only alternative, however, would point to an error of 4° or 5° in the observation (or estimation), and Scina writes of Maurolycus at this time that he was "très-avancé en âge (il avait alors 78 ans) dépourvu d'instrumens, accablá d'infirmités." . . . Zach sought unsuccessfully for the special work by Maurolycus, as well as for his "Life" by his nephew; Lalande gives no particulars of the former, and hence recourse has to be had to Clavius, who, as stated above, made some extracts from the *Judicium*.

ASTRONOMICAL PHENOMENA FOR THE WEEK, 1885, JUNE 21-27

(FOR the reckoning of time the civil day, commencing at Greenwich mean midnight, counting the hours on to 24, is here employed.)

At Greenwich on June 21

Sun rises, 3h. 45m. ; souths, 12h. 1m. 30·5s. ; sets, 20h. 18m. ; decl. on meridian, 23° 27′ N. : Sidereal Time at Sunset, 14h. 19m.

Moon (Full on June 27, 11h.) rises, 14h. 14m. ; souths, 19h. 44m. ; sets, 1h. 5m.* ; decl. on meridian, 8° 24′ S.

Planet	Rises h. m.	Souths h. m.	Sets h. m.	Decl. on meridian ° ′
Mercury	3 12	11 29	19 46	23 33 N.
Venus	4 38	12 58	21 18	23 51 N.
Mars	2 4	10 0	17 56	20 26 N.
Jupiter	9 6	16 13	23 20	12 9 N.
Saturn	3 43	11 52	20 2	22 30 N.

* Indicates that the setting is that of the following day.

Phenomena of Jupiter's Satellites

June	h. m.		June	h. m.	
21	21 9	I. occ. disap.	25	22 30	III. ecl. reap.
22	20 47	I. tr. egr.	27	20 23	I. tr. ing.

The Phenomena of Jupiter's Satellites are such as are visible at Greenwich

June	h.	
21	—	Sun at greatest declination north ; longest day in northern latitude.
24	8	Mercury at least distance from the Sun.
26	20	Venus at least distance from the Sun.
27	15	Mercury in superior conjunction with the Sun.

GEOGRAPHICAL NOTES

THE last issue of the *Izvestia* of the Russian Geographical Society (xx., 6) contains an interesting paper, by M. Kosyakoff, topographer, who accompanied, in 1882, Dr. Regel during his journey through Karategin and Darvaz. The paper deals almost exclusively with the topography of the explored region, and thus gives a plain description of the explored routes, containing the necessary topographical data for forming an opinion on the much-debated questions as to the orography of that part of the Pamir region. A route-map, on the scale of ten miles to an inch, accompanies the paper. Starting from Penjkent, M. Kosyakoff soon reached the 9800 feet high lake, Kouli-kalam. Then he crossed the 12,000 feet high and snow-covered Badkhana Mountains which separate the Zarafshan from the upper Surkhab, tributary of the Fan, and continuing to make his way amidst deep and rocky mountain-gorges, he soon reached the lake, Iskander-kul, 7120 feet above the sea-level. Thence, crossing the Mura Pass, richly clothed with vegetation on its northern slope, the expedition descended to Karatag and Hissar, and, by a route quite suitable for carriages, they proceeded further to Kabadian. A good route along the Waksh River brought Dr. Regel and his travelling companions to Kurgan-tube ; but, to reach Koulab, they had to cross the Tash-robat Pass, all covered from top to foot with pistach trees. From Kulab, which is more animated than Kabadian, the expedition went to the rich Mumin-abad Valley, peopled with Tadjiks agriculturists ; thence to the twenty-five villages of the Dara district, and, continuing their journey north-east on the right bank of the Pendj, they soon reached Kala-i-khumb. The Pendj River being there but thirty-five miles distant from Tavil-dara on the Waksh, the expedition went there before proceeding further up the Pendj, and followed the upper Waksh in a north east direction for some fifty-five miles. From Kala-i-khumb, M. Kosyakoff made a further very interesting excursion up the Pendj and its tributary, the Vantch, up to its source, whence he was compelled by a fever to return to Kala-i-khumb and thence to Samarcand. The map published by the *Izvestia* contains, moreover, the very interesting route from Tavil-dara to Bal-juan, and thence to Hissar, and further west to Baisoun, Anar-bulak, and Yar tube.

AMONG the works announced for this year by the Russian Geographical Society we see the last fascicule of the valuable "Geographical and Statistical Dictionary of Russia ;" the atlas of maps to accompany Baron Kaulbars' work on the delta of the Amu-Daria ; a geognostic map of the shores of Lake Baikal, by M. Chersky ; the work of Dr. Sperck on the Amur region ; and a work by M. de Vollan on the songs of Ugrian Russians. There is promised, also, the long-expected results of the great survey of Siberia, from the Ural Mountains to Lake Baikal, accomplished in 1874. The commander of the expedition having died since, the work had to be given for calculations to other persons ; but now the name of M. Tillo, who has undertaken its publication, is a guarantee that this capital work will not be lost to science.

DR. FISCHER, of the University of Marburg, the author of a monograph on the climate of Mediterranean countries, read a paper before a recent meeting of the Verein für Erdkunde at Halle on the morphology of the coasts of the Mediterranean, which is reprinted in the *Hallische Zeitung*. "The Mediterranean," he said, "was specially important for some investigations into physical geography, for it has been the theatre of a long history, and we have therefore information about its coasts extending over many centuries. Although it washes the shores of three continents, this sea exhibits a striking similarity in its *fauna* and *flora* everywhere. It must, therefore, in its present form, belong to one of the most recent geological periods, even though particular basins may be much older. It owes its origin to great movements in the crust of the earth, and the form of its coasts is attributable to the same cause, modified by more recent influences. In the present coast formation in the north-western basin, two different types are perceptible, which may most conveniently be designated as the North Sicilian and the Languedoc types. If we follow the coast of Italy from Naples, then the Sicilian and North African coasts around to the Straits of Gibraltar, we meet with twenty-two smaller bays having the form of a semicircle. Their sizes do not vary greatly, the chord of the smallest being 15 km., that of the largest 65, and that of the great majority between 30 and 35 kms. Over this extent the coasts are almost everywhere precipitous, and a short distance from the shore the sea deepens rapidly. How has this formation arisen?" Quoting Suess's "Das Antlitz der Erde," Dr. Fischer said, "there appeared to be all along this coast a great fissure in the crust of the earth. The formation of the Appennines, the Atlas and the occurrence of volcanic phenomena along the whole line would point to this. But this would not account for the bays here mentioned ; many of these are probably due to the sea washing away the softer from amongst the harder rocks. The projecting headlands are hard, old, crystalline rocks, while inside are the newer and softer kinds. These inlets, too, are not found everywhere along the coast, but only where the harder rocks are present. That the coasts here are greatly exposed to denudation by the action of the waves is shown by the numerous caves and cliffs, and the violent surge which beats against the vast harbour-works of the French on the coast of Algeria. The prevailing winds there are north and north-east, and thus assist the waves. Another factor is the current, which flows eastwards along the north coast of Africa from the Straits of Gibraltar. This meets the projecting capes and headlands, which deflect part of it into the bays, creating in the latter a counter-current which acts as a scour, keeping the bottom free from alluvium, and also exercising its influence on the semi-circular formation of the inlets. The Bay of Tunis is an exception. This is much deeper than the others, and the currents cannot therefore exercise the same influence over it. The alluvium is deposited, the River Medjerda brings down its contribution, and the result is a constant formation of land there. This bay belongs rather, on this account, to the second type, existing on the Mediterranean coasts of Northern Italy and Languedoc. The Tuscan coast was originally similar to that of Lower Italy, but it has now been altered beyond recognition. Here, to the west of the Appennines there is a wide district with easily-denuded rocks. The rivers, especially since man has so disafforested the region, bring down vast quantities of alluvium. The current which flows into the Tyrrhenian Sea is deflected northward along the coast, and causes the deposit of the alluvium inshore, so that the ancient bays are gradually silting up. In ancient times the shores of this now harbourless sea had numerous bays, and Tyrrhenians were skilful navigators. At the mouth of the Arno the operation is best seen. Pisa, which was founded as the port on the sea at the mouth of the river, was no longer on the coast in Strabo's time, and is now some distance inland. The land-formation on the coasts of Languedoc is even more striking. In former times there were steep shores, protected by a row of islands, behind which lay a calm inland sea, on which the city of Narbonne was built. The sea silted up from inside and out—from inside by the rivers, from outside by the currents created by the frequent south-east winds which conveyed the alluvium of the eastern rivers, especially the Rhone, and deposited it there. The islands became joined to the land, and the inland sea disappeared. Thus arose on these coasts the flat plains, behind which are small lakes and marshes.

AT the meeting of the Paris Geographical Society of May 22 further information was read respecting the expedition of M. Teisserenc de Bort to explore the Sahara. Leaving Tuggurt, they marched south-south-west to Hassi Ouled Milond, the last point visited by the Flatters mission. Thence, passing through Bereçoff, they ultimately reached Gabes. Near Ghourd-Rouned M. de Bort found well-marked traces of an old lake of sweet water, about a kilometre long, and 700 or 800 m. wide. In the depression thus created there were evidences of a prehistoric station in numerous flint arrow-heads, and from this point to Gabes the presence of man at a very ancient epoch was attested by chipped flints.—M. de Quatrefages read a paper on the Red Indians, and on the half-breeds of the United States and Canada. The position which the writer maintains is that the Indians do not diminish so rapidly as is generally believed, as, for example, the Maoris. The half-castes are put in the census as whites; Indian women married to whites are similarly counted. "Placed in favourable conditions, the Red-kins, far from diminishing in number, have increased, and are increasing. But they have not preserved their ethnic purity. Mixture with white blood has taken place even in the most remote tribes, and perhaps now the number of natives of pure blood is insignificant everywhere; but, on the other hand, the blood of the natives is mixing more and more with that of the whites, and the latter accept more easily day by day the half-breed as one of themselves." Although the Red Indians are disappearing as such, they will still live in the future true Anglo-American race. M. Henri Condreau gave a succinct account of six journeys which he made between 1881 and 1885 in Guiana. The writer is Professor at the Lycée at Cayenne, and performed two of these journeys during vacations; the others were undertaken at the request of the Governor of French Guiana. The most important one was from Manaos through the whole of Central Guiana, between the Rio Negro and Cayenne. He had already performed two-thirds of his task, and passed the sources of the Trombette, when he lost all his articles for barter amongst the Indians, and was deserted by his followers. During four months he was alone amongst savages, ultimately arriving at his destination by a forced march of thirty days through the virgin forest.

BEFORE the Society of Commercial Geography in Paris, M. Andreau described the prairies of Guiana which he traversed in his journey between the Rio Negro and Cayenne. Behind the enormous forests which extend inland from the coasts he found prairies wholly devoid of trees, where the air was dry and the climate mild. He strongly advocated the establishment of agricultural colonies there, describing the climate as in all respects the reverse of that found on the coast.

THE well-known African traveller, Major Serpa Pinto, is stated to have discovered large coal-fields south of the Rovuma River. The Rovuma is a coast river, and its estuary is situated about 11° S. lat. Along its banks runs the ancient caravan route from Cape Delgado to Lake Nyassa. The coal-fields were first claimed by the Sultan of Zanzibar, but have now been taken possession of by the Portuguese Government.

A SCIENTIFIC expedition under the charge of Lieut. Hovgaard, of the Danish Navy, is being prepared to investigate the eastern coasts of Greenland. M. Gamel, the owner of the vessel, has put it at M. Hovgaard's disposal, and the Danish Government will pay the cost of the expedition.

M. HANSEN-BLANGSTED has reported to the Geographical Society of Paris that the first steamer coming directly from the open sea arrived at Cologne on March 18. It is called the *Industry*, belongs to a company of Mannheim, and is of 513 tons burden. "This is an event important not only for Cologne, but also for every town on the Rhine."

PROF. KARL GOTTSCHE, of the University of Kiel, has just returned from his travels in Eastern Asia. After having lectured on Mineralogy and Geology for several years at Tokio, he undertook a scientific exploring expedition in Korea, at the request of the Korean Government, which lasted until December, 1884. His route extended over 3000 kilometres. Dr. Gottsche intends shortly to publish his geological, mineralogical, and ethnographical investigations of Korea. To our knowledge this is the first scientific investigation of the great East-Asiatic peninsula.

DR. H. Z. C. TEN KATE departed on May 18 from Southampton. He goes to the interior of Surinam, where he intends to devote himself to anthropological and ethnological studies. A grant has been given to him by Dr. Riebeck (Halle a/S) and Prince Roland Bonaparte.

A TELEGRAM dated "near Herat, June 9," states that, pending the settlement of the frontier question, the Frontier Commission is exploring and mapping out the country in all directions.

ON THE MESOZOIC FLORAS OF THE ROCKY MOUNTAIN REGION OF CANADA[1]

IN a previous memoir, published in the *Transactions* of the Royal Society of Canada, vol. i., the author had noticed a lower cretaceous flora consisting wholly of pines and cycads occurring in the Queen Charlotte Islands, and had described a dicotyledonous flora of Middle Cretaceous age from the country adjacent to the Peace River, and also the rich Upper Cretaceous flora of the coal formation of Vancouver's Island—comparing these with the flora of the Laramie series of the North-West Territory, which he believed to constitute a transition group connecting the Upper Cretaceous with the Eocene Tertiary.

The present paper referred more particularly to a remarkable Jurasso-Cretaceous flora recently discovered by Dr. G. M. Dawson in the Rocky Mountains, and to intermediate groups of plants between this and the Middle Cretaceous, serving to extend greatly our knowledge of the Lower Cretaceous flora and to render more complete the series of plants between this and the Laramie.

The oldest of these floras is found in beds which it is proposed to call the Kootanie group, from a tribe of Indians of that name who hunted over that part of the Rocky Mountains between the 49th and 52nd parallels. Plants of this age have been found on the branches of the Old Man River, on the Martin Creek, at Coal Creek, and at one locality far to the north-west on the Suskwa River. The containing rocks are sandstones, shales, and conglomerates, with seams of coal, in some places anthracitic. They may be traced for 140 miles in a north and south direction and form troughs included in the Palæozoic formations of the mountains. The plants found are conifers, cycads, and ferns, the cycads being especially abundant and belonging to the genera Dioonites, Zamites, Podozamites, and Anomozamites. Some of these cycadaceous plants, as well as of the conifers, are identical with species described by Heer from the Jurassic of Siberia, while others occur in the Lower Cretaceous of Greenland. The almost world-wide *Podozamites lanceolatus* is very characteristic, and there are leaves of *Salisburya sibirica*, a Siberian Mesozoic species, and branches of *Sequoia smittiana*, a species characteristic of the Lower Cretaceous of Greenland. No dicotyledonous leaves have been found in these beds, whose plants connect in a remarkable way the extinct floras of Asia and America and those of the Jurassic and Cretaceous periods.

Above these are beds which, with some of the previous species, contain a few dicotyledonous leaves, which may be provisionally referred to the genera *Sterculia* and *Laurus*; and still higher the formation abounds in remains of dicotyledonous plants, of which additional collections have been made by Mr. T. C. Weston. The beds containing these, though probably divisible into two groups, may be named the Mill Creek series, and are approximately on the horizon of the Dakota group of the United States geologists, as illustrated by Lesquereux and others. The species are described in the paper, and differ for the most part from those of the Dunvegan group of the Peace River series, which is probably of the age of the Niobrara group, and, of course, still more from the overlying Laramie group. With regard to the latter, the author adduced some new facts confirmatory of his previously expressed view as to the position of the Laramie at the top of the Cretaceous and base of the Eocene, and also tending to show that some of the plants still held by certain palæo-botanists to be of Miocene age are really, in Canada at least, fossils of the Laramie group, and consequently considerably older than is currently supposed. The collections of plants studied by the author had for the most part been placed at his disposal by the Director of the Geological Survey.

HYDROMECHANICS

THE last of the series of lectures at the Institution of Civil Engineers during the session of 1884-85 on "The Theory and Practice of Hydromechanics," was delivered on Thursday

[1] Read before the Royal Society of Canada, May, 1885, by Sir William Dawson, C.M.G., LL.D., F.R.S.

evening, May 7, by Sir Edward Reed, K.C.B., M.P., on "The Forms of Ships." The President, Sir Frederick Bramwell, F.R.S., occupied the chair.

In the course of his address the Lecturer briefly explained the great development which the science of fluid resistance had undergone of late years, largely owing to the labours of Stokes, Rankine and others, but more largely still to those admirable investigations which had been carried out under the patronage of the Admiralty by the late Dr. William Froude, and subsequently by his son, Mr. R. E. Froude. He likewise explained the very great effect which those investigations had produced in the Royal Navy, owing to the judicious and prompt adoption of Froude's results by the Admiralty Constructors. Stress was laid throughout the lecture upon the importance of adjusting the form and proportions of ships not only to the loads which they have to carry, but likewise to the weight of the materials entering into their structure. It was a common error to judge of the merits of steamships by the relations which exist between their displacement, steam power, and speed, as expressed by formulæ of various kinds. Approximations to the theoretical form of least resistance were sought by some naval designers, and all considerable departures from that form were regarded as objectionable. The Lecturer, on the contrary, pointed out that no such theoretical form was any true or proper guide for a naval designer, since every change in the average weight of the hull necessitated a corresponding change in the form and proportions of the ship, and the great merit of a designer often was that he adopted forms differing widely from the abstract forms of the schools, and presenting a very inferior appearance when put into what are known as "Constants of Performance." This was illustrated by examples derived partly from actual ships and partly from calculations made for the purpose. Two actual warships were compared, one attaining the high figure of 213 marks when examined by the received formulæ, and the other gaining but 172 marks; yet in the Lecturer's view the latter was far and away the better ship, because she performed precisely the same service as the other, being inferior in no respect, and yet had cost less than the other by £114,000, and expended no more steam-power in attaining an equal speed. The Lecturer remarked that he should probably have regarded the abstract "form of least resistance" with more respect but for the circumstance that the designing of armoured vessels in which he was much engaged is "a branch of naval construction of much too concrete and ponderous a character to admit of any dalliance with abstract or fancy forms." He went on to express his regret that, owing largely to the restrictions which granite docks imposed upon naval constructors, and to the absence of iron floating docks capable of receiving ships of any form, and owing to other causes likewise, the construction of armoured ships—by which he meant ships which had a sufficient volume protected above the water to keep them afloat and upright while the armour remained intact—had been abandoned, and the first place upon the sea had been offered to any nation which had the courage and the will to assume it. In his opinion this was a purely voluntary abandonment, and was not the result of any scientific or economic necessity. He admitted that great changes in forms and proportions were very desirable in our great line-of-battle ships; for example, a great increase of breadth was necessary in order to economise the side armour, and to keep the ram and torpedo at ample distance from the boilers and magazines, which should be protected by an inner citadel, so to speak, well removed from the outer one. But so far was true science from presenting obstacles to these and other important changes, it actually invited these very changes, and increase of beam in particular had been shown by Froude to facilitate the attainment of practical invulnerability combined with very high speed. Size and cost were among the bugbears of our naval administration; by the true engineer they were always regarded as secondary to great and noble objects, among which objects he included the naval pre-eminence of our country. At any rate, there was no engineering obstacle whatever to England constructing and sending to sea, not merely those great and swift but delicate and fragile Atlantic hotels in which the British Navy is now to embark and fight, for the want of something better, but also war-ships—real war-ships—almost as invulnerable as these islands themselves, and capable of bearing the once-proud flag of England boldly into the waters of any enemy whatever.

On the motion of the President, a cordial vote of thanks was passed to Sir Edward Reed for his interesting and instructive lecture.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

CAMBRIDGE.—In the second part of the Natural Science Tripos the examiners have placed the following in the first class in alphabetical order:—Men: Acton (Botany), St. John's; Eve, B.A. (Physics), Pembroke; Fitzpatrick (Physics), Christ's; Gordon (Physiology), Trinity; Shore (Physiology), St. John's; F. M. Young, B.A. (Physics), Trinity.

The Senior Wrangler, Mr. Berry, of King's College, was a student at University College School and College; the Second Wrangler, Mr. Love, of St. John's, was educated at Wolverhampton Grammar School. The Wranglers, thirty-four in number, are alone eligible to compete in the third part of the Mathematical Tripos a year hence.

In the Natural Sciences Tripos, Part I, the following were placed in the first class, in alphabetical order:—Men: Bury, Trinity; Couldridge, Emmanuel; Edgeworth, Caius; Evans, F. P., St. John's; Oliver, F. W., Trinity; Rolleston, St. John's; Seward, St. John's; Walters, H. G., Trinity. Women: Freund, J., Girton; Willoughby, C. A. J., Newnham.

The University Lectureship in Mathematics, lately held by Prof. J. J. Thomson, will be filled up by the General Board of Studies and the Special Board for Mathematics early in the Michaelmas Term.

It is proposed, in dealing with the increased income of the Craven Fund, to establish a new Studentship of 200*l.* a year for research in the Languages and History of Ancient Greece and Rome and the Comparative Philology of the Indo-European Languages; the Studentship to be tenable for one year, but a student might be re-elected on not more than two occasions.

It is proposed still further to systematise and improve the courses of local lectures in populous centres, and to give students University certificates and exemptions in all cases where satisfactory work has been done, instead of confining these special privileges to affiliated Colleges. The majority of the courses given in the past winter have been scientific, and the work continues to extend, under the energetic administration of Dr. R. D. Roberts. Much difficulty exists in some of the most promising centres, where the students (miners and artisans) are poor, in providing funds. There ought to be no difficulty in persuading colliery proprietors and manufacturers to find the money needed.

SCIENTIFIC SERIALS

Bulletins de la Société d'Anthropologie de Paris, 5me Fascicule, 1884.—On ancient superstitions still surviving among the Bretons, by M. Bonnemère. An interesting paper, showing among many other proofs of superstition that the peasantry believe in the possession by certain individuals, whom they characterise as "Ribotteurs," of the power of injuring others by causing their milch cows to lose their milk. The so-called "Ribotteurs" are believed to acquire this power by roaming naked through the fields on the night of April 30 to gather, at early dawn, the May dew, in which dwells the malevolent property of drying up the milk of cows.—On the uni-discoidal placenta of a mandril, by M. Chudzinski.—On the degree of atrophy of the olfactory nerves compatible with the persistence of the sense of smell, by M. Mathias Duval. The writer draws attention to the number of cases in which a post-mortem examination has proved the atrophy, or even total absence, of olfactory nerves, although there had been no apparent defect in the sense of smell during life. M. Dally is of opinion that in such cases an excess of the gray matter of the brain at any one point may serve to supplement a deficiency in some other cerebral region.—M. Topinard presented to the Society a copy of his great chart of the relative heights, registered among the conscripts and in the public schools of different parts of France.—Report of proceedings at the first meeting of the "Conférence Transformiste," organised last year in memory of Darwin. In accordance with the scheme of the Conference an address was to be annually delivered by a member of the Anthropological Society of Paris, who was to indicate the influence which Darwinian ("Transformist") views had had on the special branch of scientific inquiry which the lecturer prosecuted.—This year's address in the Physical Section of the Conference was delivered by M. Duval, who chose for his theme the evolution of the eye from the early development of the visual organs among the lower animals. His treatise is profusely illustrated by admirable dia-

grammatic woodcuts.—In the Psychical Section of the Conference M. Letourneau treated of the evolution of morality, tracing the rise and progress and various fluctuations of the moral sense among different races.—M. Pozzi, in announcing the decision of the Committee for awarding the Broca prize, explained that he and his colleagues had selected the works of three among the numerous competitors, viz. MM. Collignon, Chudzinski, and Testut, as of pre-eminent merit. The prize was, however, unanimously awarded to the last-named, M. Testut's great work, "Muscular Anomalies in Man explained by Comparative Anatomy," having secured him this distinction both on account of its able and exhaustive character and its great literary merits. The selected essays of MM. Collignon and Chudzinski, treated respectively of the "anthropometric differences of the leading races of France," and of the "Anatomy of the Negro." In his address M. Pozzi gave a summary of M. Testut's work, of which he spoke in terms of unqualified praise, both as regards the methods with which his observations had been conducted, and the manner in which the results were compared and tested.—Report of the eulogy on Paul Broca, delivered by M. Dally on the day the Broca prize was awarded for the first time. As an old friend and colleague, M. Dally, in his historical and literary notice of the life and works of Broca, was able to give many hitherto unknown particulars, which add largely to the interest of his address.

Bulletins de la Société d'Anthropologie de Paris, 1er Fascicule, 1885, containing *résumé* of the rules, organisation, and actual condition of the Society, with lists of members, affiliated societies, and recent obituary, &c., &c., &c. Among the works presented to the Society at its inaugural meeting, 1885, special notice is due to the "Elements of General Anthropology," by M. Topinard, who here gives a *résumé* of his lectures at the School of Anthropologie since 1876; the "Gitaños of Spain and Portugal," by M. Bataillard; "Ethnic Mutilations," by M. Magitot; and "Cannibalism among the Red-Skins," by M. Letourneau. In regard to each of these, the authors treated at great length of the objects aimed at in their respective works, the character and scope of which they fully explained.—M. Chudzinski presented the Society with the cast of the deltoid muscle of a negro, showing an anomalous separation of the bundles, which had a Simian character.—M. Delisle drew attention to an ox's head belonging to *Bos indicus* of Senegal, in which a perfectly developed horn protruded from between the nasal bones.—A paper by Dr. Hoffman, of Washington, on a curious relic found in South California, supposed to have been a case for keeping the colouring-matters and instruments employed in tattooing.—On the Quaternary deposits of Rosny (Nogent-sur-Marne), by M. Eck. Among these finds are fine teeth of *Elephas primigenius*, *Rhinoceros tichorhinus*, *Equus*, &c.—Report by M. Gouin, of Cagliari, on the skulls and objects found by M. Issel in the recently-opened cave at Orreri, in the Island of Sardinia. M. Issel believes, from his study of the prehistoric remains of Western France, Spain, and the basin of the Mediterranean generally, that these and the finds at Orreri all point equally to the diffusion of a primitive race, which was extant in the Canary Isles within historic times.—On Laos, by M. P. Neis, who explored the Laotian territory bordering on Cambodia in 1882-84. The author, as a French official, enjoyed exceptional advantages for travelling in Cochin China and the neighbouring districts, and his careful study of the character and habits of the people has enabled him to collect much interesting information regarding the distinctive anthropological and social characteristics of the different races of Indo-China. M. Neis sees no ground for the opinion that these races exhibit traces of a Negrito element, but he draws attention to the fact that everywhere the Mongol is displacing the Thay and other ancient nationalities, although this is most evident in the territories between Mam-on and Tonkin, and he believes that, unless the King of Siam takes prompt measures to stop this invasion, Siamese supremacy and French authority will be alike endangered.—Ceylon and its inhabitants in ancient and modern times, by M. Beauregard. The author derives his materials from English sources.—On the caves of Saumoussay, by M. Bonnemère, who believes that these grottoes served in prehistoric ages as a tannery.—On the measurements of the long-bones as a basis for the reconstruction of the entire skeleton, by M. Topinard, with plates of the osteometric instrument used by Broca.—On will, considered from a physiological point of view, by M. Fauvelle.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, May 7, with a note added May 12.—"On the Electric Resistance of a New Alloy named Platinoid." By J. T. Bottomley, M.A., F.R.S.E.

In the course of a series of experiments on the electric resistance of various metals and alloys and in particular on the variation of the electric resistance of these metals and alloys with temperature, the author has examined a new alloy (called by the inventor "platinoid"), which has turned out to have important properties.

This alloy is the invention of Mr. F. W. Martino, of Sheffield, who kindly supplied specimens of the metal, and wires specially drawn down to the finer gauges for experiments.

Platinoid is practically German silver with the addition of a small percentage (1 or 2 per cent.) of metallic tungsten. The tungsten is added in the form of phosphide of tungsten, a considerable percentage of which is in the first place fused with a portion of the copper. The nickel is then added; and then the zinc and the remainder of the copper. The mixture requires to be re-fused more than once, and during the process the phosphorus and a considerable portion of the tungsten originally added is removed as scoriæ. In the end there is obtained a beautiful white alloy, which is platinoid. When polished the alloy is scarcely distinguishable in appearance from silver. To test the quality claimed for it as to being untarnishable, the author has been keeping ornamental specimens lying exposed to the ordinary town atmosphere; and has satisfied himself that the alloy has a very remarkable power of resisting the tarnishing influence of the air of a large town.

It is, however, the electric resistance of platinoid that has chiefly interested the author. German silver wire has proved of great use in the construction of galvanometer coils and resistance coils, on account of two important properties, viz., its very high resistance and the smallness of the variation of its resistance with change of temperature. Both those properties are possessed in a still higher degree by platinoid alloy.

The resistance of German silver differs considerably in different specimens. It is commonly stated to be $21{\cdot}17 \times 10^{-6}$ B.A. ohms between opposite faces of a centimetre cube at 0° C.;[1] or, reducing to legal ohms, $20{\cdot}935 \times 10^{-6}$ legal ohms between the opposite faces of a centimetre cube. The following table shows the resistance of a number of specimens of platinoid wire:

Specifying number	Diameter in decimals of a centimetre	Cross Section	Resistance legal ohms per metre	Resistance between opposite faces of a centimetre cube legal ohms.
16	·1610	·0204300	·181	$36{\cdot}98 \times 10^{-6}$
17	·1430	·0160200	·202	32·36
18	·1230	·0119400	·288	34·38
19	·1110	·0096770	·353	34·16
20	·0865	·0058760	·555	32·61
A	·0595	·0027180	1·250	$34{\cdot}76 \times 10^{-6}$
B	·0495	·0019240	1·707	32·85
28	·0402	·0012690	2·605	33·06
29	·0340	·0009070	3·412	30·94
32	·0290	·0006605	4·371	28·87
36	·0220	·0003801	8·219	31·24

It appears from these results that the specific resistance of platinoid is about *one and a half* times that of German silver.

The experiments on the variation of resistance of platinoid with temperature were carried on in the following way. The specimen of platinoid to be tested was wound on a wooden bobbin, on the surface of which a screw had been cut, and the spires of the helix were kept separate by lying between the threads of the screw. This coil was immersed in a bath of oil, and was connected in series with a known wire of German silver, the temperature of which was kept constant, and with a single Daniell's cell. The differences of potential between the two ends of the platinoid wire and the two ends of the German silver wire were determined by applying the electrodes of a a high-resistance galvanometer. The ratio of the differences of potential is the same as the ratio of the resistances of the two wires.

[1] Given by Prof. Fleeming Jenkin, F.R.S., as expressing the results of Matthiessen's experiments.

In the following table is shown the ratio of the resistances of a specimen of platinoid wire at different temperatures to its resistance at zero. The wire used was the same as that specified as No. 20 in the table of resistances. The length of the wire experimented on was about four-fifths of a metre. The only trouble in the experiment was the keeping the oil-bath, which was filled with linseed oil, thoroughly stirred, and of uniform temperature throughout.

Temperature.	Resistance. The Res. at 0° C. being = 1.
0°	1·0
10	1·0024
20	1·0044
30	1·0075
40	1·0066
50	1·0097
60	1·0126
70	1·0134
80	1·0166
90	1·0188
100	1·0209

This gives for the average percentage variation of resistance per 1° C., between the temperatures 0° C. and 100° C., the number 0·02087. A second wire tested very carefully in a similar way gave for this average percentage variation between 0° and 100°, 0·022 per degree, with a steadily increasing rate of variation from the beginning.

To compare this increase in resistance due to increase of temperature with that observed in other metals and alloys, we find that the percentage increase of resistance for 1° C. at 20° C. for copper is 0·388, platinum-silver alloy 0·031, gold silver alloy 0·065, and for German silver 0·044. These numbers were obtained by Matthiessen in the course of his experiments for finding a suitable metal or alloy for the purpose of constructing the British Association standards of electric resistance. It appears that the variation of resistance of platinoid with temperature is very much smaller than the smallest observed for any of the metals and alloys then examined.

The modulus of rigidity, the Young's modulus (or modulus for elastic longitudinal extension), and the breaking weight for platinoid wire were also determined. The wire used was a portion of that marked *A* in the foregoing table. This wire is a little larger than No. 24 of the Board of Trade standard wire gauge, and has a diameter of 0·0595 cm.

The rigidity modulus was found to be $4751{\cdot}8 \times 10^6$ grammes weight per square centimetre. The Young's modulus is $1222{\cdot}4 \times 10^6$ grammes weight per square centimetre.

The breaking weight is about $6{\cdot}029 \times 10^6$ grammes weight per square centimetre.

The specific gravity of platinoid wire has also been found by the author to be 8·78 compared with water at 20° C. Platinoid when drawn hard is softened, like copper, by heating and sudden cooling.

Physical Society, May 23.—Prof. Guthrie, President, in the chair.—Dr. A. H. Fison was elected a Member of the Society.—The following communications were read:—Experiments showing the variations caused by magnetisation in the length of iron, steel, and nickel rods, by Mr. Shelford Bidwell. The subject of the extension and retraction of bars of iron and nickel under the action of magnetic force has been investigated by Drs. Joule and A. M. Mayer, and by Mr. Barrett. In the present experiments the magnetising force has been increased, with the result of bringing out some striking and novel characteristics. The apparatus employed consisted of a vertical magnetising helix considerably longer than the experimental rod, the latter forming the central portion of a compound rod, the two ends being of brass. The lower end of this rod is plane, and stands on a firm support; the upper end is a knife-edge, which bears against a brass lever 18 cm. in length, about 1 cm. from the fulcrum; the portion of the rod to be examined is in the central portion of the helix. The above lever is furnished with another knife-edge at the end, which acts in a similar manner on a second lever, at the extremity of which is a small mirror. A lamp and vertical scale being placed at a distance of 470 cm., the slightest motion of the mirror could be read with great accuracy, an elongation of the bar, amounting to 1-100,000th mm., being easily detected. A few of the more important results are as follow:—In the case of soft iron the bar continually increased in length till nearly saturated, up to which point Mr. Joule had traced it, but then it reached a maximum, decreased, and continued decreasing to the limit of the experiments, at which point the retraction was about double of what the extension had been. The effect depended upon the thickness of the bar, an increase of diameter diminishing the maximum extension, and increasing the critical magnetising force, or that force which produced the maximum extension; the results seemed to show that this extension varied inversely as the square root of the diameter of the bar. The general behaviour of steel was the same as that of soft iron, but the critical point varied with the hardness and temper of the metal, appearing to be a minimum for steel of yellow temper. The results of experiments upon nickel coincided with those obtained by Prof. Barrett, the effect of magnetisation being to cause a continuous retraction greater than that obtained with soft iron. In answer to Prof. Hughes, who believed that the effect of the coil was always to produce *retraction* of the bar, the *extension* at first being due to the molecular arrangement of the particles during magnetisation, Mr. Bidwell further described an experiment showing that the action of the coil was to produce the *extension* of a magnet. Two thin strips of soft iron fastened together at the ends, their central portions being about 2 cm. apart, were placed in the coil. On making the current the ends were drawn out, the sides coming together. Prof. Forbes suggested that the effect of thickness was really owing to the irregularity of magnetisation produced by the ends, and that in future experiments the middle of the bar only should be examined.—On the spectral image produced by a slowly rotating vacuum-tube, by Mr. Shelford Bidwell.—Note on the action of light in diminishing the resistance of selenium, by Mr. Shelford Bidwell. As the result of the investigation upon the behaviour of selenium, Messrs. Adams and Day arrived at the conclusion that it conducted electrolytically. Since this would necessitate the assumption that selenium is not an element according to accepted theories, caution must be exercised in accepting this. It seemed possible, however, that since the selenium in the cells had always undergone a prolonged cooking in contact with the metal terminals, selenides of these metals might exist in the selenium, forming a kind of network, and thus affording conduction through the mass, which, without the cooking, is non-conducting. It had not been possible to test this directly, but a somewhat analogous case had been tried. Some precipitated silver had been heated for some hours with sulphur, and the clear liquid poured off. A cell was then made by coiling two silver wires side by side upon a strip of mica, the spaces between the wires being filled with the prepared sulphur, which would contain a small quantity of sulphide of silver. It was found necessary to reduce the resistance of the cell by placing a small strip of silver leaf over the sulphur and cooking again. The cell thus prepared was very sensitive to light: by burning a piece of magnesium near, the resistance was reduced to one-third. Mr. Clark said that Mr. Bidwell's cells probably contained sulphides of copper or silver, substances which the researches of Faraday had shown conducted electrolytically in the solid condition. On the other hand, Cu_2Se and Ag_2Se conducted like metals and were probably often present in the ordinary selenium light cells. Mr. Clark thought that Mr. Bidwell's paper raised this question: What influence had light upon the electrolytic conduction of Cu_2S and Ag_2S and upon the metallic conduction of Cu_2Se and Ag_2Se?—On certain cases of electrolytic decomposition, by Mr. J. W. Clark.—The first part of this paper consisted of a critical examination of the behaviour of those substances which have been described as exceptions to Faraday's laws, with the object of generalising as to the condition of internal or molecular structure corresponding to their electrical properties. The second part described an experimental investigation into the nature of the conduction of fused mercuric iodide and mercuric chloride, both of which were stated to undergo electrolytic conduction. Decomposition and re-combination of the products of electrolytic action may, however, follow so closely as to simulate metallic conduction. The first product of electrolytic decomposition of mercuric iodide was stated to be iodine and mercuroso-mercuric-iodide (Hg_4I_6), which latter, under the continued action of the current, yields free mercury. Similarly it was found that fused mercuric chloride, when electrolysed between graphite terminals, split up into chlorine and mercurous chloride. Metallic conduction, *i.e.* conduction without decomposition, in fused compound solids, therefore appears to be unknown.—Note on electrical symbols, by Mr. J. Munro.

Mathematical Society, June 11.—J. W. L. Glaisher, F.R.S., President, in the chair.—Prof. J. Larmor was admitted

into the Society.—Mr. Basset read a paper on the potential of an electrified spherical bowl, and on the motion of an infinite liquid about such a bowl, upon which Prof. Larmor made some remarks.—Mr. Elliott communicated a short paper by M. Z. J. Rogers, entitled, notes on the polism of the inscribed and circumscribing polygon.—Mr. Kempe, F.R.S., made a brief communication on pairs of collinear points; and a paper by Prof. Mannheim, liaison géométrique entre les sphères osculatrices de deux courbes qui ont les mêmes normales principales, was taken as read.

Chemical Society, June 4.—Dr. Hugo Müller, F.R.S., President, in the chair.—Mr. Harold Follows was admitted as a Fellow of the Society.—The following paper was read:—On the constitution of the haloid derivatives of naphthalene, by Prof. Meldola.

Anthropological Institute, June 9.—Francis Galton, F.R.S., President, in the chair.—Prince Roland Bonaparte exhibited a large collection of photographs of Lapps.—Mr. P. A. Holst exhibited three water-coloured photographs out of a collection of 240, representing all the tribes of the Russian empire.—Dr. J. G. Garson read a paper on the physical characteristics of the Lapps; and by the permission of the authorities of the Alexandra Palace, the family of Lapps now being exhibited there were present in the room with their sleigh, reindeer skins, and dog. The group consists of three men, two women, and two young children. The average height of the men is 5 feet 1½ inches, that of the women 4 feet 11½ inches. The chief characteristics of the Lapps may be said to be their low stature, round heads, and large cranial capacity.—Prof. Keane read a paper on the Lapps: after glancing at their origin, ethnical relations and nomenclature, explaining the perplexing terms Lapp, Finn, Same, &c., the Professor proceeded to describe their present habitat, their national and political divisions, and population; not more than about 30,000 Lapps remain, and their number appears to be diminishing. Their social usages were then described, and allusion made to their reindeer, dogs, sledges, snow-shoes, and tents, and the paper concluded with an account of their religion, education, present condition, and future prospects.—A paper by Dr. H. Rink on Eskimo dialects was taken as read.

EDINBURGH

Mathematical Society, June 12.—Dr. Thomas Muir in the chair.—Prof. Tait gave an address on the detection of amphicheiral knots, with special reference to the mathematical processes involved.

PARIS

Academy of Sciences, June 8.—M. Bouley, President, in the chair.—Action of chloroxicarbonic ether on the cyanate of potassium, by MM. Wurtz and Henninger. In an accompanying note it is stated that this important posthumous monograph was mostly prepared in 1875, but that its publication was delayed by the authors in order to complete their researches on various points. After the death of M. Wurtz the work was continued by M. Henniger, who was about to publish the results when he also fell a victim to his arduous labours. In its present form the paper has been prepared and edited by M. Edouard Grimaux.—Memoir on the temperature of the atmosphere and ground at the Paris Natural History Museum during the years 1883 and 1884, by MM. Edmond Becquerel and Henri Becquerel. This memoir forms a continuation of the researches begun twenty-two years ago at the Museum by M. A. C. Becquerel, by means of the thermo-electric apparatus invented by him.—On the geographical distribution of animal and vegetable species as affected by the climatic conditions, the character of the soil, the disposition of land and water, the progress of culture, and other outward influences of the environment, by M. Emile Blanchard.—Propagation of the earthquake shock felt in Andalusia on December 25, 1884, a rectification, by M. F. Fouqué.—On a new order of metallic spectra, by M. Lecoq de Boisbaudran.—Note on a new vegetable type from the lower coralline formations of Auxes, in the neighbourhood of Baune, Côte d'Or, by M. G. de Saporta. This type, by the author named Changarniera, from its first observer, appears to be of lacustrine origin, and to bear a certain relation to the Rhizocaulon from the freshwater chalk-formations of the South of France, still surviving in Provence. It may, perhaps, represent one of those proangiosperm types, the existence of which has only begun to be suspected by botanists.—Note on some recently-discovered documents connected with the infancy of Jean Le Rond d'Alembert, by M. L. Lallemand. These inedited records show that, contrary to Condorcet's statement, d'Alembert was sent to the Maison de la Couche, and placed with a nurse for six weeks in a Picardy village, after which he was consigned to the charge of Jacques Molin (Dumoulin), one of the most distinguished physicians of the time.—On a method of rapidly analysing all the nitrogen contained in substances in the organic, ammoniacal, and nitric state, by M. A. Houzeau.—On a method of employing the sextant in such a way as to obtain by a single observation the simultaneous altitudes or angles of two stars, of a star and the moon, or of a star and the sun, by M. Gruey.—On the convergence of a continuous algebraic fraction, by M. Halphen.—Remarks on the radiations emitted by incandescent carbons, such as those prepared for use in lighthouses for the production of voltaic arcs, by M. Félix Lucas.—Remarks on the apparatus usually employed for the measurement of continuous and other electric currents, by M. Mascart.—A thermo-chemical study of electric accumulators, by M. Tscheltzow.—Note on the action of silver, copper, iron, and some other metals on a mixture of acetylene and air, by M. F. Bellamy. The author's experiments show that in the burner these metals, and especially copper, act on acetylene in the same way that platinum does on hydrogen.—Note on the sulphurets of cerium and lanthane, by M. Debray.—On a new reaction for digitaline, by M. Ph. Lafon. This reaction, which is extremely sensitive, will enable the chemist to distinguish more sharply than has hitherto been possible between the numerous products employed in therapeutics under the general name of digitaline.—Note on aseptol (orthoxiphenylsulphurous acid), by M. E. Serrant. For this substance (so named by the author from the Greek negative particle ἀ and σηπτόν, corruption) it is claimed that it will be found three times superior to phenic acid as a practical antiseptic.—On electric alcoholic fermentation, by M. Em. Bourguelot.—Remarks on the tail of the human embryo, by M. H. Fol. From his researches the author is satisfied that during the fifth and sixth weeks of its development the human embryo is furnished with a tail in the strict anatomical sense of the term. Being destitute of all physiological use, this organ must be classed with all other rudimentary members.—On the natural evolution of the cantharides, by M. H. Beauregard. The results are here embodied of three years' research, during which the author has succeeded in clearing up many obscure points connected with the physiological life and functions of these insects.—Note on the extraction and composition of the gases contained in the leaves of plants, by MM. N. Gréhaut and Peyrou.

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